

CITY OF BERKELEY

DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECTS



PROJECT MANUAL

Fire Warehouse Interior and Site Improvement Project

SPECIFICATION NO. 24-11654-C

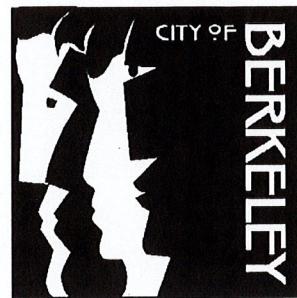
July, 2024

ADVERTISEMENT DATE: July 15, 2024

PRE-BID CONFERENCE: Tuesday, July 30, 2024

BID OPENING DATE: 2:00 PM Tuesday, August 27, 2024

CITY OF BERKELEY
DEPARTMENT OF PUBLIC WORKS



PROJECT MANUAL

Fire Warehouse Interior and Site Improvement Project

at

1011 Folger Avenue
Berkeley, CA 94710

SPECIFICATION NO. 24-11654-C
July, 2024

Prepared By:


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ENGINEERING DIVISION
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DOCUMENT 00 1113**NOTICE INVITING BIDS****ARTICLE 1 - INVITATION TO BID**

- 1.01 Notice Inviting Bids:** City of Berkeley ("City") will receive sealed Bids at City of Berkeley, Purchasing Manager's Office, located at the Martin Luther King Jr. Civic Center, 2180 Milvia Street, Third Floor, Berkeley, CA 94704, Telephone (510) 981-7320, until **2:00 PM Tuesday, August 27, 2024** for the following public work:

**SPECIFICATION NO. 24-11654-C
CITY OF BERKELEY
Fire Warehouse Interior and Site Improvement Project
1011 Folger Avenue**

- 1.02 Project Description: Interior upgrades and site improvements to the Fire Warehouse,** including ancillary work in accordance with the terms and conditions of the Contract Documents. Work shall be completed within **168** Calendar Days from the date when Contract Time commences to run.
- 1.03 Procurement of Bidding Documents:** Bidding Documents contain the full description of the Work. Bidders may obtain Bidding Documents by 2:00 PM TUesday, August 27, 2024 from City of Berkeley's Public Works website under Current Construction Project Bid Opportunities:
<https://berkeleyca.gov/doing-business/working-city/bid-proposal-opportunities>
For information pertaining to the Bidding Documents, please contact the Project Manager, Uriel Gonzalez, 1947 Center Street, 5th Floor, Berkeley, CA 94704, by Email at UGonzalez@berkeleyca.gov or by Telephone at (510) 981-6627 or by FAX (510) 981-6390.
- 1.04 Planholders List:**
Bidders are responsible for notifying Uriel Gonzalez, via email at UGonzalez@berkeleyca.gov to be included on the Planholders List. Please include the following in the email subject header: "Planholders list for Specification No. 24-11654-C for Fire Warehouse Interior and Site Improvement Project". In the body of the email, please state the Name of the Company Representative, Company Name, Address, Telephone Number, Fax Number, and Email Address.
- 1.05 Instructions:** Bidders shall refer to Document 00 2113 (Instructions to Bidders) for required documents and items to be submitted in a sealed envelope for deposit into the Bid Box, located at **City of Berkeley, Purchasing Manager's Office, Martin Luther King Jr. Civic Center, 2180 Milvia Street, Third Floor, Berkeley, CA 94704, Telephone (510) 981-7320** no later than the time and date set forth in Paragraph 1.01 above.
- 1.06 Non-Mandatory Pre-Bid Site Visit:** City **WILL** conduct a Non-Mandatory Pre-Bid Conference and Site Visit at 1011 Folger Avenue. The location of work is not open to the public during normal business or daylight hours. It is recommended that potential bidders visit the site independently to review site conditions prior to bid. City will conduct a Pre-Bid Conference and Site Visit at 1011 Folger Avenue, at 11:00 AM Tuesday, July 30, 2024
- 1.07 Bid Preparation Cost:** Bidders are solely responsible for the cost of preparing their Bids.
- 1.08 Reservation of Rights:** City specifically reserves the right, in its sole discretion, to reject any or all Bids, to re-bid, or to waive inconsequential defects in bidding not involving time, price or quality

of the work. City may reject any and all Bids and waive any minor irregularities in the Bids.

ARTICLE 2 - LEGAL REQUIREMENTS

- 2.01 Required Contractor's License(s):** A California "B" contractor's license is required to bid this contract. Joint ventures must secure a joint venture license prior to award of this Contract. Specialty work may require a specialty contractor's license, held by Bidder or a listed subcontractor.
- 2.02 Bid Alternates:** Bid alternates are identified in Document 00 4113 (Bid Form). The determination of lowest bid shall be based upon: Base contract bid price only.
- 2.03 Substitution of Securities:** City will permit the successful bidder to substitute securities for any retention monies withheld to ensure performance of the contract, as set forth in Document 00 6290 Escrow Agreement For Security Deposits In Lieu Of Retention and incorporated herein in full by this reference, in accordance with Section 22300 of the California Public Contract Code.
- 2.04 Prevailing Wage Laws:** The successful Bidder must comply with all prevailing wage laws applicable to the Project, and related requirements contained in the Contract Documents. 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 State of California Department of Industrial Relations, are on file at <http://www.dir.ca.gov/oprl/pwd/> and are deemed included in the Bidding Documents. The successful Bidder shall post the applicable prevailing wage rates at the Site.
- 2.05 Community Workforce Agreement:** This contract **WILL** be subject to the Community Workforce Agreement approved by the Berkeley City Council on June 23, 2015 (See Document 00 6580 – City of Berkeley Contracting Policies). The successful bidder and all subcontractors, at any tier, **WILL** be required to sign an Agreement to be Bound as a condition precedent to entering into any contract for this project.
- 2.06 First Source Construction Agreement:** This contract **WILL NOT** be subject to the First Source Construction Agreement (See Document 00 6580 – City of Berkeley Contracting Policies).
- 2.07** This contract **WILL NOT** be subject to Supplementary Conditions for Federal Funding. Section 00 7201.

END OF SECTION

DOCUMENT 00 2113**INSTRUCTIONS TO BIDDERS**

Bids are requested by City of Berkeley ("City"), for a general construction contract, or work described in general, as set forth in Document 00 1113 (Notice Inviting Bids), and the following additional terms.

ARTICLE 1 - PROCEDURES FOR SUBMISSION OF BIDS**1.01 Required Pre-Bid Conference and Site Visit**

- A. City **WILL** conduct a Non-Mandatory Pre-Bid Conference and Site Visit at 1011 Folger Avenue, at Tuesday, July 30, 2024. The location of work is open to the public during normal business or daylight hours. It is recommended that potential bidders visit the site independently to review site conditions prior to bid.
- B. Questions regarding the site and the Bid Documents may be sent to the City's Representative to clarify such matters as Bidders may request. The Site Visit may be the Bidders' only opportunity to investigate conditions at the Site. Other Pre-Bid Site Visits may be scheduled at City's sole discretion, depending on staff availability.
- C. City will issue Minutes of the Pre-Bid Conference, which shall constitute the sole and exclusive record and statement of the results of the Pre-Bid Conference. The Minutes issued by City are not Contract Documents.

1.02 Required Pre-Bid Investigations

- A. Prior to submission of Bid, Bidder must conduct a careful examination of Bidding Documents and understand the nature, extent, and location of Work to be performed. Refer to Document 00 7200 (General Conditions) on required pre-bid investigations.
- B. Bidders may examine any available existing conditions information (e.g., record documents, specifications, studies, drawings of previous work), as well as applicable environmental assessment information (if any) regarding the Project, which will be posted on the website location indicated in Document 00 1113 (Notice Inviting Bids), paragraph 1.03.

1.03 Bidder Questions and Answers

- A. Bidders must direct all questions about the meaning or intent of Bidding Documents to City's Project Manager in writing as indicated in Document 00 1113 (Notice Inviting Bids), paragraph 1.03. Interpretations or clarifications considered necessary by City in response to such questions will be issued by written Addenda posted to the City's website.
- B. Questions received less than ten (10) calendar days prior to the date for opening Bids may not be answered.
- C. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect, and Bidders shall not rely on oral statements.

1.04 Addenda

- A. Addenda may also be issued to modify the Bidding Documents as deemed advisable by City. Addenda shall be acknowledged by number in Document 00 4113 (Bid Form) and shall be part of the Contract Documents. A complete listing of Addenda may be secured from City on the website as indicated in Document 00 1113 (Notice Inviting Bid), paragraph 1.03.
 1. It is the Contractor's responsibility to check the City's website for Addenda prior to submitting their bid.

ARTICLE 2 - RECEIPT OF BIDS**2.01 Date and Time**

- A. Sealed Bids will be received by the City until the date and time indicated in Document 00 1113 (Notice Inviting Bids). All Bid envelopes will be time-stamped to reflect their submittal time. City shall reject all Bids received after the specified time and will return such Bids to Bidders unopened. Bidders must submit Bids in accordance with this Document 00 2113.

2.02 Two Envelope Bid Submission:

- A. City will receive Bids in opaque sealed 10 inch x 13 inch envelopes, containing the required items described herein.
- B. Bidders must submit Bids in two envelopes: "Envelope A – Bid Submittals" and "Envelope B – Statement of Qualifications."
- C. Bidders should mark their Bid envelopes using the name, address, identifying information and specification number, indicated in Document 00 1113 (Notice Inviting Bids).

2.03 Required Contents of "Envelope A – Bid Submittals"

- A. Document 00 4113 (Bid Form). Bidders must submit Bids on Document 00 4113 (Bid Form) in accordance with the provisions of Document 00 4113. Bidders must complete all Bid items and supply all information required by Bid documents and specifications.
- B. Document 00 4313 (Bond Accompanying Bid). Bidders must submit Document 00 4313 (Bond Accompanying Bid) accompanied by a cashier's check, certified check (certified without qualification and drawn on a solvent bank of the State of California or a National Bank doing business in the State of California) or completed form of Document 00 4313 of not less than 10% of the base Bid, payable to City and completed in accordance with the provisions of Document 00 4313.
- C. Document 00 4314 (Bidder Registration and Experience Form). Bidders must submit Document 00 4314 (Bidder Registration and Experience Form), completed in accordance with the provisions of Document 00 4314.
- D. Document 00 4330 (Subcontractor List). Bidders must submit Document 00 4330 (Subcontractors List) completed in accordance with the provisions of Document 00 4330. The Subcontractors List must include the names of all subcontractors 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 the total Bid amount. Any violation of this requirement may result in a Bid being deemed non-responsive and not being considered.
- E. Document 00 4519 (Non-Collusion Affidavit). Bidders must submit Document 00 4519 (Non-Collusion Affidavit) completed in accordance with the provisions of Document 00 4519.
- F. Document 00 4546 (Bidder Certifications). Bidders must submit Document 00 4546 (Bidder Certification) completed in accordance with the provisions of Document 00 4546.

2.04 Required Contents of "Envelope B – Statement of Qualifications"

- A. Document 00 4513 (Statement of Qualifications for Construction Work). Bidder must submit Document 00 4513 (Statement of Qualifications for Construction Work) in accordance with the provisions of Document 00 4513.

ARTICLE 3 - BID OPENING AND EVALUATION**3.01 Determination of Apparent Low Bidder**

- A. City will open each Bidders' Envelope A at the time and place indicated in Document 00 1113 (Notice Inviting Bids), initially evaluate them for responsiveness, and determine an Apparent Low Bidder as specified herein.

- B. Apparent Low Bid will be determined solely on the total amount of all Bid items based on terms contained in Document 00 1113 (Notice Inviting Bids) and Document 00 4113 (Bid Form). All Bidders are required to submit Bids on all Bid items (including any alternates).
- C. For the purposes of award, the apparent low Bidder will be the conforming responsible Bidder offering the lowest total amount for the Total Base Bid shown in the Bid Form. Once the low bidder is determined as herein described, the City reserves the right to award any combination of Additive Bid alternates, or not award any Additive Bid alternates, as it deems to be in the best interest of the City, regardless of whether the total bid of the particular combination selected is higher or lower than any other bidder for that same combination.
- D. For the Apparent Low Bidder only, City will open Envelope B and evaluate the Apparent Low Bidder for responsiveness to the requirements of Document 00 4513 and for Responsibility.
- E. If Apparent Low Bidder is determined to be non-responsive or non-responsible, then City may proceed to the next Apparent Low Bidder's Bid pursuant to any procedures determined in its reasonable discretion, and proceed for all purposes as if this Apparent Low Bidder were the original Apparent Low Bidder.

3.02 Evaluation of Bids

- A. Bids must be full, complete, clearly written and using the required forms. Bidders shall make any change in the Bid by crossing out the original entry, entering and initialing the new entry. Bidder's failure to submit all required documents strictly as required entitles City to reject the Bid as non-responsive. All Bidders must submit Bids containing each of the fully executed documents supplied in this Project Manual.
- B. In evaluating Bids, City will consider Bidders' qualifications, whether or not the Bids comply with the prescribed requirements, unit prices, and other data, as may be requested in Document 00 4113 (Bid Form) or prior to the Notice of Award.
- C. City may conduct reasonable investigations and reference checks of Bidder and other persons and organizations as City deems necessary to assist in the evaluation of any Bid and to establish Bidder's responsibility, qualifications, financial ability and ability to perform the Work in accordance with the Contract Documents to City's satisfaction within the prescribed time. Submission of a Bid constitutes Bidder's consent to the foregoing.
- D. City shall have the right to consider information provided by sources other than Bidder. City shall also have the right to communicate directly with Bidder's surety regarding Bidder's bonds.
- E. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between written words and figures will be resolved in favor of the words.
- F. Bids shall be deemed to include the written responses of the Bidder to any questions or requests for information of City made as part of Bid evaluation process after submission of Bid.

3.03 Reservation of Rights

- A. City reserves the right to reject any or all nonconforming, non-responsive, unbalanced, or conditional Bids, and to reject the Bid of any Bidder as non-responsive as a result of any error or omission in the Bid, or if City believes that it would not be in the best interest of Project 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 City. For purposes of this paragraph, an "unbalanced Bid" is one having nominal prices for some Bid items and enhanced prices for other Bid items.
- B. City may retain Bid securities and Bid bonds of other than the Apparent Low Bidder for a period of 90 Days after award or full execution of the Contract, whichever first occurs.
- C. City may reject any or all Bids and waive any informalities or minor irregularities in the Bids. City also reserves the right, in its discretion, to reject any or all Bids and to re-Bid the Project.

ARTICLE 4 - MANDATORY BID PROTEST PROCEDURES**4.01 Submission of Written Bid Protest**

- A. Any Bid protest in connection with the construction contract or work described in general in Document 00 1113 (Notice Inviting Bids) must be submitted in writing to the Project Manager as indicated in Document 00 1113, paragraph 1.03 before 3:30 p.m. of the fifth Business Day following opening of the Bidders' envelopes.
- B. The initial protest document must contain a complete statement of the basis for the protest.
- C. The protest must refer to the specific portion of the document that forms the basis for the protest.
- D. The protest must include the name, address, and telephone number of the person representing the protesting party.
- E. Only Bidders who the City otherwise determines are responsive and responsible are eligible to protest a Bid; protests from any other Bidder will not be considered. In order to determine whether a protesting Bidder is responsive and responsible, City may evaluate all information contained in any protesting Bidder's Bid, and conduct the same investigation and evaluation as City is entitled to take regarding an Apparent Low Bidder.
- F. The party filing the protest must concurrently transmit a copy of the initial protest document 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 who appear to have a reasonable prospect of receiving an award depending upon the outcome of the protest.

4.02 Exclusive Remedy

- A. The procedure and time limits set forth in this paragraph are mandatory and are Bidder's sole and exclusive remedy in the event of Bid protest. Bidder's 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. A Bidder may not rely on a protest submitted by another Bidder, but must timely pursue its own protest.

ARTICLE 5 - AWARD AND EXECUTION OF CONTRACT**5.01 Notice of Intent to Award and Submittal of Executed Contract Documents**

- A. If Contract is to be awarded, it will be awarded to the lowest responsible responsive Bidder. City will issue Document 00 5100 Notice of Intent to Award. Such Award, if made, will be made within sixty (60) calendar days after the opening of the Bid Proposals.
- B. Successful Bidder must execute and submit to City the "Required Contract Documents and Proof of Insurance" set forth below, by 5:00 p.m. of the 10th calendar Day following the Notice of Intent to Award.

5.02 Required Contract Documents and Proof of Insurance

- A. Document 00 5200 (Agreement), fully executed by successful Bidder. Submit two originals and an emailed PDF, each bearing an original signature (in blue ink) and initials on each page.
- B. Document 00 6113.13 (Construction Performance Bond), fully executed by successful Bidder and surety, in the amount set forth in Document 00 6113.13. Submit two originals and an emailed PDF.
- C. Document 00 6113.16 (Construction Labor and Material Payment Bond), fully executed by successful Bidder and surety, in the amount set forth in Document 00 6113.16. Submit two originals and an emailed PDF.
- D. Document 00 6536 (Guaranty), fully executed by successful Bidder. Submit two originals and an emailed PDF.
- E. Insurance certificates and endorsements required by Document 00 7316 (Supplementary Conditions — Insurance and Indemnification): Submit one original set and an emailed PDF.
- F. Document 006580 (City Contracting Policies), fully executed by successful bidder. Submit one original set and an emailed PDF.

5.03 Failure to Execute and Deliver Documents:

- A. If Bidder to whom Contract is awarded, within the period described in this Document 00 2113, fails or neglects to execute and deliver all required Contract Documents and file all required bonds, insurance certificates, and other documents, City may, in its sole discretion, rescind the award, recover on Bidder's surety bond, or deposit Bidder's cashier's check or certified check for collection, and retain the proceeds thereof as liquidated damages for Bidder's failure to enter into the Contract Documents. Bidder agrees that calculating the damages City may suffer as a result of Bidder's failure to execute and deliver all required Contract Documents would be extremely difficult and impractical and that the amount of Bidder's required Bid security shall be the agreed and presumed amount of City's damages.
- B. Upon such failure to timely deliver all required Contract Documents as set forth herein, City may determine the next Apparent Low Bidder and proceed accordingly. Such Award, if made, will be made within sixty (60) calendar days after the opening of the Bid Proposals.

ARTICLE 6 - GENERAL CONDITIONS AND REQUIREMENTS**6.01 Modification of Commencement of Work:**

- A. City expressly reserves the right to modify the date for the Commencement of Work under the Contract and to independently perform and complete work related to Project. City accepts no responsibility to Contractor for any delays attributed to its need to complete independent work at the Site.
- B. City shall have the right to communicate directly with Apparent Low Bidder's proposed performance bond surety, to confirm the performance bond. City may elect to extend the time to receive faithful performance and labor and material payment bonds.

6.02 Conformed Project Manual:

- A. Following Award of Contract, City may prepare a conformed Project Manual reflecting Addenda issued during bidding, which will, failing objection, constitute the approved Project Manual.

6.03 Payment Bond:

- A. If the Project described in Document 00 1113 (Notice Inviting Bids) involves an expenditure in excess of twenty-five thousand dollars (\$25,000), the successful Bidder must file a payment bond with and approved by City prior to entering upon the performance of the Work, in accordance with Civil Code § 3247.

6.04 Wage Rates:

- A. The successful Bidder must comply with all prevailing wage laws applicable to the Project, and related requirements contained in the Contract Documents. 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 State of California Department of Industrial Relations, are on file at <http://www.dir.ca.gov/oprl/pwd/> and are deemed included in the Bidding Documents. The successful Bidder shall post the applicable prevailing wage rates at the Site.

6.05 Withdrawal of Bids:

- A. Bidders may withdraw their Bids at any time prior to the Bid opening time fixed in this Document 00 2113, only by written request for the withdrawal of Bid filed with City's Purchasing Department, at 2180 Milvia Street, 3rd Floor, Berkeley, CA 94704. Bidder or its duly authorized representative shall execute request to withdraw Bid.

6.06 Ineligible Contractors and Subcontractors:

- A. No contractor or subcontractor may be listed on a bid proposal for a public works project unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5 [with limited exceptions from this requirement for bid purposes only under Labor Code section 1771.1(a)].

- B. City shall not accept a Bid from a Bidder who is ineligible to bid or work on, or be awarded, a public works project pursuant to California Labor Code section 1777.1 or 1777.7. Bidders and the Contractor who is awarded the project contract shall not utilize, or allow work by, any subcontractor who is ineligible to bid or work on, or be awarded, a public works project pursuant to California Labor Code Section 1777.1 or 1777.7. (See California Public Contract Code Section 6109.) The California Division of Labor Standards Enforcement publishes a list of debarred contractors and subcontractors on the Internet at www.dir.ca.gov/DLSE/debar.html.

6.07 Substitutions:

- A. Bidders must base their Bids on products and systems specified in Contract Documents or listed by name in Addenda. City will consider substitution requests only for "or equal items." Bidders wanting to use "or equal" item(s) may submit Document 00 6325 (Substitution Request Form) no later than 35 calendar days after Notice of Award. As a limitation on Bidder's privilege to request substitution of "or equal" items, City has found that certain items are designated as City standards and certain items are designated to match existing items in use on a particular public improvement either completed or in the course of completion or are available from one source. As to such items, City will not permit substitution. Such items are described in the Bidding Documents.

6.08 Definitions:

- A. All abbreviations and definitions of terms used in this Document 00 2113 are set forth in Document 00 7200 (General Conditions) and Section 01 4200 (References and Definitions).

END OF SECTION

DOCUMENT 00 3132**GEOTECHNICAL DATA AND EXISTING CONDITIONS****ARTICLE 1 - REPORTS AND INFORMATION ON EXISTING CONDITIONS****1.01 Inspection of Reports:**

- A. City, its consultants, and prior contractors may have collected documents providing a general description of the Site and conditions of the Work. These documents may consist of geotechnical reports for and around the Site, contracts, contract specifications, tenant improvement contracts, as-built drawings, utility drawings, and information regarding Underground Facilities (collectively, "Existing Conditions Data".)
- B. Bidders may inspect Geotechnical and Existing Conditions Data. These documents are listed in Section 01 1100 (Summary) and are available for review at the address identified therein. Copies may be obtained for the cost of reproduction and handling upon Bidder's payment for the costs.
- C. Existing Conditions Data is for information only and does not describe labor, materials or equipment furnished by Contractor, but rather, information regarding conditions of the work. Such Existing Conditions Data is not a Contract Document.

ARTICLE 2 - USE OF EXISTING CONDITIONS DATA**2.01 Above-Ground Existing Conditions:**

- A. City makes no warranty or representation of existing aboveground conditions, as-built conditions, or other aboveground actual conditions verifiable by reasonable independent investigation. These conditions are verifiable by Bidder by the performance of its own independent investigation that Bidder must perform prior to bidding and Bidder must not rely on the information supplied by City regarding existing conditions.
- B. Bidder represents and agrees that in submitting its Bid, it is not relying on any information regarding above-ground existing conditions supplied by City.

2.02 Underground Facilities:

- A. Information supplied regarding existing Underground Facilities at or contiguous to the Site is based on information furnished to City by others (e.g., the builders of such Underground Facilities or others).
- B. City assumes responsibility for only the general accuracy, completeness or thoroughness of information regarding Underground Facilities that are owned by City. This express assumption of responsibility applies only if Bidder has conducted the independent investigation required of it under Document 00 7200 (General Conditions) and discrepancies were not apparent. Bidder is solely responsible for any interpretation or conclusion drawn from this information.
- C. City is not responsible for information regarding Underground Facilities owned by others.

2.03 Hazardous Materials Surveys:

- A. Bidders may rely on this data and information for general accuracy regarding the locations of potentially hazardous materials subject of the Work. City does not warrant and makes no representation regarding the completeness or thoroughness of any data or information regarding existing conditions or hazardous materials, including, but not limited to, quantities, characteristics, volumes, or associated structural features. Bidder represents and agrees that in submitting a Bid it is not relying on any such data, information or deductions.
- B. Data and information regarding the locations of hazardous materials are not part of Contract Documents.

2.04 Geotechnical Data:

- A. Bidder may rely upon the general accuracy of the "technical data" contained in the geotechnical reports and drawings identified above, but only insofar as it relates to subsurface conditions,

- provided Bidder has conducted the independent investigation required of it and discrepancies were not apparent.
- B. 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. The term "technical data" shall not include the location of Underground Facilities.
 - C. Bidder may not rely on the completeness of reports and drawings for the purposes of bidding or construction. Bidder is solely responsible for any interpretation or conclusion drawn from any "technical data" or any other data, interpretations, opinions, or information contained in supplied geotechnical data.
 - D. Except as expressly set forth in this Document 00 3132, City does not warrant, and makes no representation regarding, the accuracy or thoroughness of any geotechnical data.
 - E. Bidder represents and agrees that in submitting its Bid, it is not relying on any geotechnical data supplied by City, except as specifically set forth herein.

ARTICLE 3 - INVESTIGATIONS

3.01 Required Investigations:

- A. Before submitting a Bid, each Bidder shall be responsible to obtain such 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, which may affect cost, progress, performance or furnishing of Work or which 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 which 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. Bidders shall advise City in writing during the Bid period of any questions, suppositions, inferences or deductions Bidders may have for City's review and response.
- C. City has provided time in the period prior to bidding for Bidder to perform these investigations.

3.02 Access to Site for Investigations:

- A. During the Pre-Bid Site Visit(s), City 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. The Bidder may request alternate dates and times to access the site. Such request must be made in writing at least ten (10) calendar days prior to bid. Bidders must fill all holes and clean up and restore the Site to its former conditions upon completion of such explorations, investigations, tests, and studies. Such investigations may be performed only under the provisions of Document 00 2113 (Instructions to Bidders) and Document 00 7200 (General Conditions) including, but not limited to, proof of insurance and obligation to indemnify against claims arising from such investigation work. Each Bidder shall supply all equipment required to perform any investigations as each Bidder deems necessary. City has the right to limit the number of pieces of machinery operating at one time due to safety concerns.

END OF SECTION

DOCUMENT 00 4113
BID FORM

TO CITY OF BERKELEY

THIS BID IS SUBMITTED BY:

(Firm/Company Name)

Re:Fire Warehouse Interior and Site Improvement Project at 1011 Folger Avenue, Specification No. 24-11654-C

1. The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an agreement with City of Berkeley in the form included in the Contract Documents, Document 00 5200 (Agreement), to perform and furnish all Work as specified or indicated in the Contract Documents for the Contract Sum and within the Contract Time indicated in this Bid and in accordance with all other terms and conditions of the Contract Documents.
2. Bidder accepts all of the terms and conditions of the Contract Documents, Document 00 1113 (Notice Inviting Bids), and Document 00 2113 (Instructions to Bidders), including, without limitation, those dealing with the disposition of Bid Security. This Bid will remain subject to acceptance for 60 calendar days after the day of Bid opening, unless there is a bid protest, then 90 calendar days after the day of bid opening. Bidder will sign and submit Document 00 5200 (Agreement) and other documents required by Document 002113, paragraph 5.02 (Required Contract Documents and Proof of Insurance) within 20 calendar days after receipt of City's Notice of Intent to Award.
3. In submitting this Bid, Bidder represents that Bidder has examined all of the Contract Documents, performed all necessary Pre-Bid investigations as set forth in Document 00 5200 (Agreement) Article 6 (Contractor's Representation), received the Pre-Bid conference minutes (if any), and received the following Addenda:

Addendum Number	ADDENDUM DATE	Signature of Bidder

4. Based on the foregoing, Bidder proposes and agrees to fully perform the Work within the time stated and in strict accordance with the Contract Documents for the following sums of money listed in the following Schedule of Bid Prices:

SCHEDULE OF BID PRICES

All Bid items, including lump sums and unit prices, must be filled in completely. Bid items are described in Section 01 1100 (Summary of Work). Quote in figures only, unless words are specifically requested.

ITEM	DESCRIPTION	Quantity	Unit	PRICE (\$)
1	All work of the Contract Documents Except Deferred Submittals.	1	LS	
2	Deferred Submittal: MODIFICATIONS/ALTERATIONS TO THE EXISTING FIRE SPRINKLER SYSTEM	1	LS	
3	Deferred Submittal: MODIFICATIONS/EXTENSION OF EXISTING FIRE ALARM SYSTEM	1	LS	
4	Deferred Submittal: METAL STAIR	1	LS	
5	2025 Refrigerant Changes Allowance	1	LS	\$25,000
	Total Bid Price: (Bid Items 1 through 5)			

Total Bid Price: (Bid Items 1 Through 5)

(Words)

(Deduct) Alternates

ITEM	DESCRIPTION	PRICE (\$)
1	Deduct Alternate 1: N/A	
2		
3		

5. Subcontractors for work included in all Bid items are listed on Document 00 4330 (Subcontractors List) submitted herewith.

6. The undersigned Bidder understands that City reserves the right to reject this Bid, but that this Bid shall remain open and shall not be withdrawn for a period of sixty (60) calendar days from the date prescribed for its opening.
7. If written notice of the acceptance of this Bid, hereinafter referred to as Notice of Intent to Award, is mailed or delivered to the undersigned Bidder within the time described in Paragraph 2 of this Document 00 4113 or at any other time thereafter before it is withdrawn, the undersigned Bidder will execute and deliver the documents required by Document 00 2113 (Instructions to Bidders) within the times specified therein.
8. Notice of Award or request for additional information may be addressed to the undersigned Bidder at the address set forth below.
9. The undersigned Bidder herewith encloses cash, a cashier's check, or certified check of or on a responsible bank in the United States, or a corporate surety bond furnished by a surety authorized to do a surety business in the State of California, in form specified in Document 00 2113 (Instructions to Bidders), in the amount of ten percent (10%) of the Total Bid Price and made payable to City of Berkeley.
10. The undersigned Bidder agrees to commence Work under the Contract Documents on the date established in Document 00 7200 (General Conditions) and to complete all Work within the time specified in Document 00 5200 (Agreement).
11. The undersigned Bidder agrees that, in accordance with Document 00 7200 (General Conditions), liquidated damages for failure to complete all Work in the Contract within the time specified in Document 00 5200 (Agreement) shall be as set forth in Document 00 5200.
12. The names of all persons interested in the foregoing Bid as principals are:

IMPORTANT NOTICE: If Bidder or other interested person is a corporation, give the legal name of corporation, state where incorporated, and names of president and secretary thereof; if a partnership, give name of the firm and names of all individual co-partners composing the firm; if Bidder or other interested person is an individual, give first and last names in full.

NAME OF BIDDER: _____

licensed in accordance with an act for the registration of Contractors, and with license number: _____ Expiration: _____.

(Place of Incorporation, if Applicable)

(Principal)

(Principal)

(Principal)

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

(Signature of Bidder)

NOTE: If Bidder is a corporation, set forth the legal name of the corporation together with the signature of the officer or officers authorized to sign contracts on behalf of the corporation. If Bidder is a partnership, set forth the name of the firm together with the signature of the partner or partners authorized to sign contracts on behalf of the partnership.

Business Address: _____

Contractor's Representative(s): _____
(Name/Title)

(Name/Title)

(Name/Title)

Officers Authorized to Sign Contracts

(Name/Title)

(Name/Title)

(Name/Title)

Telephone Number(s): _____
(Area Code) (Number)

(Area Code) (Number)

Fax Number(s): _____
(Area Code) (Number)

(Area Code) (Number)

Date of Bid: _____

END OF SECTION

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DOCUMENT 00 4313
BOND ACCOMPANYING BID

KNOW ALL BY THESE PRESENTS:

That the undersigned

,
(Name of Contractor)

as Principal and the undersigned as Surety are held and firmly bound unto City of Berkeley,
as obligee, in the penal sum of _____

(Dollar Amount in Words)

Dollars (\$_____) lawful money of the United States of America being at least ten
percent (10%) of the aggregate amount of said Principal

_____ 's base Bid, for the payment of which,
well and truly to be made, we bind ourselves, our successors, executors, administrators, and assigns,
jointly and severally, firmly by these presents.

WHEREAS, the said Principal is submitting a Bid for

Specification No. 24-11654-C
Fire Warehouse Interior and Site Improvement Project
at 1011 Folger Avenue.

THE CONDITION OF THIS OBLIGATION IS SUCH that if the Bid submitted by the said Principal
be accepted and the Contract be awarded to said Principal and said Principal shall within the required
periods enter into the Contract so awarded and provide the required Construction Performance Bond,
Construction Labor and Material Payment Bond, insurance certificates, Guarantee, and all other
endorsements, forms, and documents required under Document 00 2113 (Instructions to Bidders), then
this obligation shall be void, otherwise to remain in full force and effect.

IN WITNESS WHEREOF, the above bounden parties have executed this instrument this _____
day of _____, 20 _____.
(Month)

(Corporate Seal)

By _____
Principal

By _____
Surety

(Corporate Seal)

By _____
Attorney in Fact

END OF SECTION

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DOCUMENT 00 4314
BIDDER REGISTRATION FORM
INSTRUCTIONS

In order to register to undertake work for City of Berkeley, Bidder **must**:

- 1) Fill out this registration form completely; do not leave blanks.
 - 2) Provide certificates of insurance or a letter evidencing coverage complying with Document 00 4513 (Statement of Qualifications).

INDEPENDENT CONTRACTOR REGISTRATION

Contractor's License # _____

Date: _____ Fed I.D. # _____

Full Corporate Name of Company: _____

Street Address: _____

Mailing Address: _____

Phone: _____ Fax: _____

Name of Principal Contact: _____

Type of Business: Sole Proprietor Partnership
 Non-Profit 501(c)(3) Corporation
 other (please explain: _____)

INSURANCE

Workers' Compensation:

Carrier: _____

Address: _____

Phone and Fax:

Policy Number: _____

General Liability:

Carrier: [REDACTED]

Address: _____

Phone and Fax: _____

Policy Number: _____

Policy Limits: \$ _____

A.M. Best Rating: _____

Automobile Liability:

Carrier: _____

Address: _____

Phone and Fax: _____

Policy Number: _____

Policy Limits: \$ _____

A.M. Best Rating: _____

All-risk Course of Construction (if applicable, as required by Document 00 7316 [Supplementary Conditions – Insurance]):

Carrier: _____

Address: _____

Phone and Fax: _____

Policy Number: _____

Policy Limits: \$ _____

A.M. Best Rating: _____

Professional Liability (if applicable, as required by Document 00 7316 [Supplementary Conditions – Insurance]):

Carrier: _____

Address: _____

Phone and Fax: _____

Policy Number: _____

Policy Limits: \$ _____

A.M. Best Rating: _____

**Pollution Legal Liability Insurance (if applicable, as required by Document 00 7316
[Supplementary Conditions – Insurance]):**

Carrier: _____

Address: _____

Phone and Fax: _____

Policy Number: _____

Policy Limits: \$ _____

A.M. Best Rating: _____

BIDDER CERTIFIES, UNDER PENALTY OF PERJURY, THAT THE FOREGOING INFORMATION IS CURRENT AND ACCURATE AND AUTHORIZES OWNER, AND ITS AGENTS AND REPRESENTATIVES TO OBTAIN A CREDIT REPORT AND/OR VERIFY ANY OF THE ABOVE INFORMATION.

SIGNATURE

DATE

SAFETY EXPERIENCE

The following statements as to the Bidder's safety experience are submitted with the Bid, as part thereof, and the Bidder guarantees the truthfulness and accuracy of all information.

1. List Bidder's interstate Experience Modification Rate for the last three years.

[20_] ____ [20_] ____ [20_] ____

2. Use Bidder's last year's Cal/OSHA 300 log to fill in the following number of injuries and illnesses:

- a. Number of lost workday cases _____
 - b. Number of medical treatment cases _____
 - c. Number of fatalities _____
3. Employee hours worked last year _____
 4. State the name of Bidder's safety engineer/manager: _____

Attach a resume or outline of this individual's safety and health qualifications and experience.

I CERTIFY, UNDER PENALTY OF PERJURY, THAT THE FOREGOING INFORMATION IS CURRENT AND ACCURATE AND I AUTHORIZE OWNER, AND ITS AGENTS AND REPRESENTATIVES TO OBTAIN A CREDIT REPORT AND/OR VERIFY ANY OF THE ABOVE INFORMATION.

BIDDER:

By: _____
Signature

Its: _____
Title

Date _____

END OF SECTION

DOCUMENT 00 4330
SUBCONTRACTORS LIST

Bidder submits the following information as to the subcontractors Bidder intends to employ if awarded the Contract.

Full Name of Subcontractor (Sub.) and Address of Mill or Shop	Sub.'s License No.	Description of Work: Reference to Bid Items	Sub.'s Bid Amount	Sub.'s Depart. Of Industrial Relations No.

(Bidder to attach additional sheets if necessary)

END OF SECTION

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DOCUMENT 00 4513**STATEMENT OF QUALIFICATIONS FOR CONSTRUCTION PROJECTS****ARTICLE 1 – GENERAL INFORMATION****1.01 Minimum Bidder Qualifications.**

- A. Bidders must be duly licensed in accordance with the California Business & Professions Code and have a history of work performance sufficient to meet the requirements of a responsible bidder in the California Public Contract Code Section 1104.
- B. Bidders must have three (3) years experience as a continuously operating entity engaged in the performance of similar work.
- C. Bidders must demonstrate successful experience with type of work of this Project, to include, within the past year, completed two (2) projects of a similar nature and complexity with a contract dollar amount of (i.) at least 75% of the amount of Bidder's Bid or (ii.) 125% of such amount in the aggregate.

1.02 Measurement.

- A. Bidder's compliance with the minimum qualification requirements will be measured by Bidder's experience as an operating entity and also by the experience of the supervisory personnel who will have responsible charge of the various major components of the Work.
- B. If Bidder subcontracts portions of the Work, City, in its determination of whether the minimum qualification requirements have been met, may consider the qualifications of the Subcontractor's supervisory personnel.
- C. The qualifications of the Key Personnel are to be submitted with the Statement of Qualifications ("SOQ"), by providing the information described in this Document 00 4513.

ARTICLE 2 – Required Contents of SOQ Submission**2.01 Transmittal Letter**

- A. The Transmittal Letter shall name the proposed prime contractor, its legal structure (i.e., corporation, partnership, limited partnership, joint venture). If a joint venture or partnership is proposed, Bidder shall identify partner and/or member of the joint venture and their roles and responsibilities.

2.02 Submittals:

- A. Completed Questionnaire. Bidder shall include a completed Statement of Qualification Questionnaire in the form attached to this Document 00 4513 as Attachment "A".
- B. License: Evidence of a valid contractor's license and required licenses of all licensees of persons who are Key Personnel necessary to perform the Work.
- C. Litigation History. Description of litigation history for the past three years, including names of involved parties, nature of dispute, and disposition.

2.03 Additional Submittals:

After bid opening, Contractor maybe required to supply the City with the following submittals upon request.

- A. Resumes of Proposed Key Personnel. Bidder shall provide a resume for each named Key Personnel of Bidder, to include as necessary: Years of experience; Education - degrees, schools and years obtained; Professional Registrations; Fluency in English (Yes/No); At least two client references, including contact names, addresses and telephone numbers, and description of projects of a similar nature worked on in the past five years.

- B. Audited or Reviewed Financial Statements. Include audited or reviewed financial statements for the three most recently completed fiscal years for Bidder and each member of any proposed consorting or joint venture. Also include audited or reviewed financial statements for the three most recently completed fiscal years for any parent companies) of Bidder and each member of any proposed consortium oriole venture.
- C. Surety Letter re: Capability to Provide Required Performance and Payment Bonds. Bidder shall include a letter from a surety duly licensed to do business in the State of California, having a financial rating from A.M. Best Company of A-, VIII or better, that the surety has agreed to provide Bidder with the required performance and payment bonds in accordance with the requirements set forth in Documents 00 6113.13 (Construction Performance Bond) and 00 6113.16 (Construction Labor and material Payment bold), each in the penal sum of the Contractor's bid when submitted. Owner shall have the right to verify with the surety that the surety, based upon the Bid prices, will issue the required bonds under the conditions stated.
- D. Insurer Letter re: Capability to Provide the Required Insurance. Bidder shall provide a letter from an insurance underwriter, having a financial rating reasonably acceptable to City, confirming that the insurer will provide Bidder the required coverages and amounts specified in the Contract Documents.
- E. Description of Human and Physical Resources. Bidder shall identify, describe, and quantify for itself, the following technical information for the construction work: Description and location of manufacturing facilities, naming products and quantifying production capacity and current demand; Description of field organization(s), naming skills and equipment; Description of safety program quality control procedures, and safety experience.

2.04 Format.

- A. The SOQ shall be clear and concise to enable management-oriented personnel to make a thorough evaluation and arrive at a sound determination as to whether the SOQ meet City's requirement. To this end, the SOQ should be so specific, detailed and complete as to demonstrate clearly and fully that the Bidder has a thorough understanding of and has demonstrated knowledge of the requirements to perform the Work (or applicable portion thereof).
- B. Any explanation requested by a Bidder regarding the meaning or interpretation of this Document 00 4513 must be requested in writing and with sufficient time allowed for a reply to reach Bidder before the submission of its SOQ. Oral explanations or instructions will not be binding. Any information provided to any prospective Bidder concerning this Document 00 4513 will be furnished to all prospective Bidders as an Addendum to the Bidding Documents.

STATEMENT OF QUALIFICATION QUESTIONNAIRE FOLLOWS ON NEXT PAGE

ATTACHMENT "A" – STATEMENT OF QUALIFICATION QUESTIONNAIRE

Bidders shall complete the entire Statement of Qualification Questionnaire and submit it in accordance with Document 00 2113 (Instructions to Bidders) and Document 00 4513 (Statement of Qualifications). Failure to complete the questionnaire or inclusion of any false statement(s) shall be ground for immediate disqualification.

CONTACT INFORMATION

Company Name: _____

Owner of Company: _____

Contact Person: _____

Address: _____

Phone: _____ Fax: _____

PART A: GENERAL INFORMATION

1. Does Bidder possess a valid and current California Contractor's license for the work proposed? Yes ____ No ____
2. Does Bidder have a minimum of **\$2,000,000** liability insurance coverage? Yes ____ No ____
3. Has Bidder's License been revoked at any time in the last five years? Yes ____ No ____
4. Has Bidder been "default terminated" by an Owner (other than for convenience), or has a Surety completed a contract for Bidder within the last five years? Yes ____ No ____
5. Has Bidder been convicted more than twice for failure to pay prevailing wages in the last three years? Yes ____ No ____
6. Will Bidder provide copies of its reviewed or audited financial statements and accompanying notes for the last three years, if requested? Yes ____ No ____

**Bidder may be disqualified if any answer to questions 1, 2, or 6 is No.
Bidder may be disqualified if any answer to questions 3, 4, or 5 is Yes.**

PART B: SAFETY, PREVAILING WAGE, DISPUTES AND BONDS**(SAFETY)**

1. Has Cal/OSHA, Federal OSHA, the EPA or any Air Quality Management Owner cited Bidder in the past five years?
Yes ____ No ____ If yes, attach description of each citation.
2. How often does Bidder require documented safety meetings be held for:

Field Supervisor	Weekly ____	Bi-Weekly ____	Monthly ____	Less Than Monthly ____
Employees	Weekly ____	Bi-Weekly ____	Monthly ____	Less Than Monthly ____
New Hires	Weekly ____	Bi-Weekly ____	Monthly ____	Less Than Monthly ____
Subcontractors	Weekly ____	Bi-Weekly ____	Monthly ____	Less Than Monthly ____
3. How often does Bidder conduct documented safety inspections?
Quarterly ____ Semi-annually ____ Annually ____ Other ____

4. Does Bidder have home office safety representatives who visit/audit the job site?
Quarterly _____ Semi-annually _____ Annually _____ Other _____
5. What is Bidder's Interstate Experience Modification Rate? _____. (A rating in excess of [1] may constitute grounds for disqualification as non-responsible).

(PREVAILING WAGE PROVISIONS)

6. Has Bidder been fined, penalized or otherwise found to have violated any prevailing wage or labor code provision? If yes, attach description of each occurrence.
Yes _____ No _____

(LICENSE PROVISIONS)

7. Has Bidder changed names or license numbers in the past 5 years? If so, please state reason for change.
Yes _____ No _____ Reason: _____

(DISPUTES)

8. Has Bidder had any claims, litigation, or disputes ending in mediation or arbitration, or termination for cause associated with any project in the past 5 years? If yes, attach description of each instance including details of total claim amount, settlement amount, and Owner's name and phone number.
Yes _____ No _____

(BONDING)

9. Bonding Capacity – Provide documentation from Bidder's surety identifying the following:
Name of bonding company/surety: _____

Name of Surety Agent: _____

Surety Agent address: _____

Surety Agent phone number: _____

Is surety a California-admitted surety? Yes _____ No _____

Is surety listed in the current edition of the California Department of the Treasury's Listing of approved sureties? Yes _____ No _____

List surety's A.M. Best Rating: _____

What is Bidder's total bonding capacity? _____

What percent does Bidder pay for bonds? _____

PART C: EXPERIENCE OF PRIME CONTRACTOR

The nature of this Project requires prior similar experience for the firm and the Key Personnel assigned. Summarize similar project experience below and provide the detailed project information requested:

Prime Contractor. List three projects of similar size and scope to the Work of the Contract, completed in the past two (2) years, and indicate who were the superintendent, project manager and scheduler.

NOTE: this listing will be used to assess compliance with the stated minimum qualifications in Section 1.01.

Project Name	Construction Cost (\$)	Year Completed	Name of Project Superintendent	Name of Project Manager	Name of Project Scheduler

List Key Personnel that will be assigned to the Work of the current Project and their experience/training with the projects listed above:

Project Manager: _____

Project Superintendent: _____

Project Scheduler: _____

Recent Projects.

Provide information about three (3) of its most currently completed projects. Names and references must be current and verifiable. This listing will be used to assess compliance with the stated minimum qualifications in Section 1.01. If a separate sheet is used, it must contain all of the following information:

1. Project Name: _____

Location: _____

Owner: _____

Owner Contact (name and phone): _____

Architect/Engineer: _____

Architect/Engineer Contact (name and phone number): _____

Const. Mgr. or Project Mgr. (name and phone number): _____

Description of Project, Scope of Work Performed: _____

Total Construction Cost: _____

Total Change Order Amount: _____

Did Change Orders exceed 10% of original contract sum? _____ If yes, please explain on separate sheet.

Original Scheduled Date of Completion: _____

Time Extensions Granted (number of calendar days): _____

Actual Date of Completion: _____

Number of Stop Notices filed by Subcontractors or Suppliers: _____

2. Project Name: _____

Location: _____

Owner: _____

Owner Contact (name and phone): _____

Architect/Engineer: _____

Architect/Engineer Contact (name and phone number): _____

Const. Mgr. or Project Mgr. (name and phone number): _____

Description of Project, Scope of Work Performed: _____

Total Construction Cost: _____

Total Change Order Amount: _____

Did Change Orders exceed 10% of original contract sum? _____ If yes, please explain on separate sheet.

Original Scheduled Date of Completion: _____

Time Extensions Granted (number of calendar days): _____

Actual Date of Completion: _____

Number of Stop Notices filed by Subcontractors or Suppliers: _____

3. Project Name: _____

Location: _____

Owner: _____

Owner Contact (name and phone): _____

Architect/Engineer: _____

Architect/Engineer Contact (name and phone number): _____

Const. Mgr. or Project Mgr. (name and phone number): _____

Description of Project, Scope of Work Performed: _____

Total Construction Cost: _____

Total Change Order Amount: _____

Did Change Orders exceed 10% of original contract sum? _____ If yes, please explain on separate sheet.

Original Scheduled Date of Completion: _____

Time Extensions Granted (number of calendar days): _____

Actual Date of Completion: _____

Number of Stop Notices filed by Subcontractors or Suppliers: _____

PART D: FINANCIAL INFORMATION

1. Has Bidder ever reorganized under the protection of bankruptcy laws?
Yes _____ No _____ If yes, please state when _____
2. If Bidder has had the general liability carrier identified in Document 00 4314 (Bidder Registration and Safety Experience Form) for less than 5 years, please provide additional information below for balance of the last 5 years:

Agency Name: _____

Contact Name: _____

Phone Number _____

Carrier: _____ A.M. Best Rating: _____

Carrier: _____ A.M. Best Rating: _____

Carrier: _____ A.M. Best Rating: _____

3. Has Bidder ever had insurance terminated by a carrier? Yes _____ No _____
If yes, explain on a separate signed sheet marked with correlating cross-reference to this paragraph of the questionnaire.

Bidder hereby declares under penalty of perjury that all the information provided in this questionnaire is true and correct.

SIGNATURE

TITLE

END OF SECTION

DOCUMENT 00 4519
NON-COLLUSION AFFIDAVIT

PUBLIC CONTRACT CODE §7106

NON-COLLUSION AFFIDAVIT TO BE EXECUTED BY BIDDER AND SUBMITTED WITH BID

STATE OF CALIFORNIA)
)
) ss.
COUNTY OF)

_____, being first duly sworn,
(Name of Principal of Bidder)

deposes and says that he or she is _____
(Office of Affiant)

of _____, the party
(Name of Bidder)

making the foregoing Bid, that the Bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the Bid is genuine and not collusive or sham; that Bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham Bid, and has not directly or indirectly colluded, conspired, connived or agreed with any bidder or anyone else to put in a sham Bid, or that anyone shall refrain from bidding, and that the Bidder has not in any manner, directly or indirectly, sought by agreement, communication or conference with anyone to fix the Bid price of Bidder or any other bidder, or to fix any overhead, profit or cost element of the Bid price, or of that of any other bidder, or to secure any advantage against City , or anyone interested in the proposed contract; that all statements contained in the Bid are true; and further, that Bidder has not, directly or indirectly, submitted its Bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company association, organization, Bid depository, or to any member or agent thereof to effectuate a collusive or sham Bid.

Executed under penalty of perjury under the laws of the State of California:

(Name of Bidder)

(Signature of Principal)

Subscribed and sworn before me _____

This _____ day of _____, 20 ____

Notary Public of the State of _____

In and for the County of _____

My Commission expires _____

(Seal)

NOTE: If Bidder is a partnership or a joint venture, this affidavit must be signed and sworn to by every member of the partnership or venture.

NOTE: If Bidder [including any partner or venturer of a partnership or joint venture] is a corporation, this affidavit must be signed by the Chairman, President, or Vice President and by the Secretary, Assistant Secretary, Chief Financial Officer, or Assistant Treasurer.

NOTE: If Bidder's affidavit on this form is made outside the State of California, the official position of the person taking such affidavit shall be certified according to law.

END OF SECTION

DOCUMENT 00 4546

BIDDER CERTIFICATIONS

TO BE EXECUTED BY ALL BIDDERS AND SUBMITTED WITH BID

The undersigned Bidder certifies to City as set forth in sections 1 through 5 below.

1. STATEMENT OF CONVICTIONS

By my signature hereunder, I hereby swear, under penalty of perjury, that no more than one final, unappealable finding of contempt of court by a Federal Court has been issued against Bidder within the past two years because of failure to comply with an order of a Federal Court or to comply with an order of the National Labor Relations Board.

2. CERTIFICATION OF WORKER'S COMPENSATION INSURANCE

By my signature hereunder, as the Contractor, I certify that I am aware of the provisions of Section 3700 of the Labor Code which require every employer to be insured against liability for worker's 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.

3. CERTIFICATION OF PREVAILING WAGE RATES AND RECORDS

By my signature hereunder, as the Contractor, I certify that I am aware of the provisions of Section 1773 of the California Labor Code, which requires the payment of prevailing wage on public projects. Also, that the Contractor and any subcontractors under the Contractor shall comply with California Labor Code §1776, regarding wage records, and with California Labor Code §1777.5, regarding the employment and training of apprentices. It is the Contractor's responsibility to ensure compliance by any and all subcontractors performing work under this Contract.

4. CERTIFICATION OF COMPLIANCE WITH PUBLIC WORKS CHAPTER OF LABOR CODE

By my signature hereunder, as the Contractor, I certify that I am aware of Sections 1777.1 and 1777.7 of the California Labor Code and Contractor and Subcontractors and am eligible to bid and work on public works projects.

5. CERTIFICATION OF ADEQUACY OF CONTRACT AMOUNT

By my signature hereunder, as the Contractor, pursuant to Labor Code Section 2810(a), I certify that, if awarded the Contract based on the undersigned's Bid, the Contract will include funds sufficient to allow the Contractor to comply with all applicable local, state, and federal laws or regulations governing the labor or services to be provided. I understand that Owner will be relying on this certification if it awards the Contract to the undersigned.

BIDDER:

_____ (Name of Bidder)

Date: _____, [20] By: _____
(Signature)

Name: _____
(Print Name)

Its: _____
(Title)

END OF SECTION

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DOCUMENT 00 5100**NOTICE OF INTENT TO AWARD**

Dated _____

TO: _____

ADDRESS: _____

CONTRACT NO.: _____

CONTRACT FOR: City of Berkeley
Fire Warehouse Interior and Site Improvement Project AT 1011 Folger Avenue

The Contract Sum of your contract is _____ Dollars and _____ Cents (_____).

1. Two copies of the proposed Contract Documents listed below accompany this Notice of Award.
2. You must comply with the following conditions precedent by **5:00 p.m. of the 20th Day** following the date of this Notice of Award, that is, by **Day of Week, Month Day, Year**.
 - a. Deliver to Owner **two** fully executed counterparts and an emailed PDF copy of Document 00 5200 (Agreement). Each copy of Document 00 5200 (Agreement) must bear your original signature on the signature page and your initials on each page.
 - b. Deliver to Owner **two** originals and an emailed PDF of Document 00 6113.13 (Construction Performance Bond), executed by you and your surety.
 - c. Deliver to Owner **two** originals and an emailed PDF of Document 00 6113.16 (Construction Labor and Material Payment Bond), executed by you and your surety.
 - d. Deliver to Owner **two** original copies and an emailed PDF of Document 00 6536 (Guaranty), each executed by you.
 - e. Deliver to Owner **one** original set and an emailed PDF of the insurance certificates with endorsements required under Document 00 7316 (Supplementary Conditions – Insurance).
 - f. Deliver to Owner **one** original copy and an emailed PDF of all documents found in Document 00 6580 (City of Berkeley Contracting Policies) executed by you.
3. Failure to comply with these conditions within the time specified will entitle Owner to consider your Bid abandoned, to annul this Notice of Award, and to declare your Bid security forfeited.
4. Within 21 calendar days after you comply with the conditions in Paragraph 2 of this Document 00 5100, Owner will return to you one fully signed counterpart of Document 00 5200 (Agreement) with [number] copies of the Project Manual (including Specifications and Drawings) and [number] sets of full-size Drawings.
5. Before you may start any Work at the Site, you must attend a preconstruction conference. The preconstruction conference may be arranged through **Uriel Gonzalez (510) 981-6627**. Questions

regarding bonds and insurance and all other inquiries regarding the Project may be directed to **Uriel Gonzalez** at the same number.

6. Upon commencement of the Work, you and each of your Subcontractors shall certify and provide Owner copies of payroll records on forms provided by the Division of Labor Standards Enforcement, in accordance with California Labor Code §1776.

OWNER

BY: _____
(Title)

(Print Name)

ATTEST: _____
Secretary

(Print Name)

AUTHORIZED BY [CITY / COUNTY / DISTRICT] RESOLUTION:

NO: _____

ADOPTED: _____, [20____]

[Copy of Resolution Attached]

END OF DOCUMENT

DOCUMENT 00 5200**AGREEMENT**

THIS AGREEMENT, dated this [date] day of [Month], [20____], by and between _____ whose place of business is located at _____ ("Contractor"), and **City of Berkeley** ("City"), acting under and by virtue of the authority vested in Owner by the laws of the State of California.

SPECIFICATION NUMBER 24-11654-C

**Fire Warehouse Interior and Site Improvement Project
at
1011 Folger Avenue**

NOW, THEREFORE, in consideration of the mutual covenants hereinafter set forth, Contractor and City agree as follows:

ARTICLE 1 – SCOPE OF WORK OF THE CONTRACT**1.01 WORK OF THE CONTRACT**

- A. Contractor shall complete all Work specified in the Contract Documents, in accordance with the Specifications, Drawings, and all other terms and conditions of the Contract Documents (**Work**).

1.02 PRICE FOR COMPLETION OF THE WORK

- A. City shall pay Contractor the following Contract Sum _____ for completion of Work in accordance with Contract Documents as follows: [INSERT LUMP SUM]
- B. The Contract Sum includes all allowances (if any).

ARTICLE 2 – COMMENCEMENT AND COMPLETION OF WORK**2.01 COMMENCEMENT OF WORK**

- A. Contractor shall commence Work on the date established in the Notice to Proceed (**Commencement Date**).
- B. City reserves the right to modify or alter the Commencement Date.

2.02 COMPLETION OF WORK

- A. Contractor shall achieve Substantial Completion of the entire Work within **140** calendar days from the Commencement Date.
- B. Contractor shall achieve Final Completion of the entire Work **168** calendar days from the Commencement Date.

ARTICLE 3 – PROJECT REPRESENTATIVES**3.01 CITY'S PROJECT MANAGER**

- A. City has designated Uriel Gonzalez as its Project Manager to act as City's Representative in all matters relating to the Contract Documents.
- B. Project Manager shall have final authority over all matters pertaining to the Contract Documents and shall have sole authority to modify the Contract Documents on behalf of City, to accept work, and to make decisions or actions binding on City, and shall have sole signature authority on

behalf of City.

- C. City may assign all or part of the Project Manager's rights, responsibilities and duties to a Construction Manager, or other City Representative.

3.02 CONTRACTOR'S PROJECT MANAGER

- A. Contractor has designated [] or other] as its Project Manager to act as Contractor's Representative in all matters relating to the Contract Documents.

3.03 ARCHITECT/ENGINEER

- A. _____ furnished the Plans and Specifications and shall have the rights assigned to Architect/Engineer in the Contract Documents.
- B. Architect/Engineer has designated _____ as its project manager, to act as its representative for receiving and making communications authorized under the Contract Documents.

ARTICLE 4 – LIQUIDATED DAMAGES FOR DELAY IN COMPLETION OF WORK

4.01 LIQUIDATED DAMAGE AMOUNTS

- A. As liquidated damages for delay, Contractor shall pay City three thousand six hundred dollars (\$3,600.00) for each Day that expires after the time specified herein for Contractor to achieve Substantial Completion of the entire Work, until achieved.
- B. As liquidated damages for delay, Contractor shall pay City three thousand six hundred dollars (\$3,600.00) for each Day that expires after the time specified herein for Contractor to achieve Final Completion of the entire Work, until achieved.

4.02 SCOPE OF LIQUIDATED DAMAGES

- A. Measures of liquidated damages shall apply cumulatively.
- B. Limitations and stipulations regarding liquidated damages are set forth in Document 00 7200 (General Conditions).

ARTICLE 5 – CONTRACT DOCUMENTS

- 5.01** Contract Documents consist of the following documents, including all changes, Addenda, and Modifications thereto:

Document 00 5100	Notice of Award
Document 00 5200	Agreement
Document 00 5500	Notice to Proceed
Document 00 6113.13	Construction Performance Bond
Document 00 6113.16	Construction Labor and Material Payment Bond
Document 00 6536	Guaranty
Document 00 6530	Release of Claims
Document 00 6325	Substitution Request Form
Document 00 6290	Escrow Agreement for Security Deposits
Document 00 6580	City of Berkeley Contracting Policies
Document 00 7200	General Conditions
Document 00 7201	Supplementary Conditions
Document 00 7316	Supplementary Conditions – Insurance
Document 00 7317	Supplemental Conditions – Contracting Policies
Document 00 7319	Supplemental Conditions – Hazardous Materials
Document 00 7380	Apprenticeship Programs
Document 00 9113	Addenda

Specifications Divisions 1 through 9
Maps, Drawings and Sketches listed in Document 00 0115

- 5.02** There are no Contract Documents other than those listed above. The Contract Documents may only be amended, modified or supplemented as provided in Document 00 7200 (General Conditions).

ARTICLE 6 – CONTRACTOR'S REPRESENTATIONS

In order to induce City to enter into this Agreement, Contractor makes the following representations and warranties:

- 6.01** Contractor has visited the site 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 which relate to any aspect of the means, methods, techniques, sequences or procedures of construction to be employed by Contractor and safety precautions and programs incident thereto.
- 6.02** Contractor has examined thoroughly and understood all reports of exploration and tests of subsurface conditions, as-built drawings, drawings or reports, available for Bidding purposes, of physical conditions, including Underground Facilities, identified in the Bid Documents, or which may appear in the Drawings, and accepts the determination set forth in these documents and Document 00 7200 General Conditions of the limited extent of the information contained in such reports and drawings upon which the Contractor may be entitled to rely. Contractor agrees that except for the information so identified, Contractor does not and shall not rely on any other information contained in such reports and drawings.
- 6.03** Contractor has conducted or obtained and has understood all such examinations, investigations, explorations, tests, reports and studies (in addition to or to supplement those referred to in Article 6.02 above) which pertain to the subsurface conditions, as-built conditions, Underground Facilities and all other physical conditions at or contiguous to the site or otherwise which may affect the cost, progress, performance or furnishing of Work, as Contractor 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 the Contract Documents, including specifically the provisions of the General Conditions; and no additional examinations, investigations, explorations, test, reports, studies or similar information or data are or will be required by Contractor for such purposes.
- 6.04** Contractor 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.
- 6.05** Contractor has given the Project Manager prompt written notice of all conflicts, errors, ambiguities or discrepancies that it has discovered in or among the Contract Documents and as-built and actual conditions and the written resolution thereof through Addenda issued by Project Manager is acceptable to Contractor.

ARTICLE 7 – MISCELLANEOUS

- 7.01** Terms and abbreviations used in this Agreement are defined in Document 00 7200 (General Conditions) and Section 01 4200 (References and Definitions) and will have the meaning indicated therein.
- 7.02** It is understood and agreed that in no instance are the persons signing this Agreement for or on

behalf of City or acting as an employee, agent, or representative of City, liable on this Agreement or any of the Contract Documents, or upon any warranty of authority, or otherwise, and it is further understood and agreed that liability of City is limited and confined to such liability as authorized or imposed by the Contract Documents or applicable law.

- 7.03** In entering into a public works contract or a subcontract to supply goods, services or materials pursuant to a public works contract, Contractor or Subcontractor offers and agrees to assign to the awarding body all rights, title and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. §15) or under the Cartwright Act (Chapter 2 (commencing with §16700) of Part 2 of Division 7 of the Business and Professions Code), arising from purchases of goods, services or materials pursuant to the public works contract or the subcontract. This assignment shall be made and become effective at the time City tenders final payment to Contractor, without further acknowledgment by the parties.
- 7.04** 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 State of California Department of Industrial Relations, are deemed included in the Contract Documents and on file at Owner's Office, and shall be made available to any interested party on request. Pursuant to California Labor Code §§ 1860 and 1861, in accordance with the provisions of Section 3700 of the Labor Code, every contractor will be required to secure the payment of compensation to his employees. Contractor represents that it is 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 Contractor shall comply with such provisions before commencing the performance of the Work of the Contract Documents.
- 7.05** No contractor or subcontractor may be listed on a bid proposal for a public works project (submitted on or after March 1, 2015) unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5 [with limited exceptions from this requirement for bid purposes only under Labor Code section 1771.1(a)].
No contractor or subcontractor may be awarded a contract for public works project (awarded on or after April 1, 2015) unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5

This project is subject to compliance monitoring and enforcement by the Department of Industrial Relations.
- 7.06** This Agreement and the Contract Documents shall be deemed to have been entered into in the County of Alameda, State of California, and governed in all respects by California law (excluding choice of law rules). The exclusive venue for all disputes or litigation hereunder shall be in the Superior Court for the County of Alameda.

IN WITNESS WHEREOF the parties have executed this Agreement in triplicate the day and year first above written.

CITY OF BERKELEY

By: _____
City Manager

(Print Name)

By: _____
(Signature)

Its: _____
Title (If Corporation: Chairman, President or Vice President)

Attest:
CITY OF BERKELEY

City Clerk

(Print Name)

By: _____
(Signature)

Its: _____
Title (If Corporation: Secretary, Assistant Secretary, Chief Financial Officer or Assistant Treasurer)

Pre-approved as to form:
CITY ATTORNEY
8/2016

END OF DOCUMENT

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DOCUMENT 00 5500**NOTICE TO PROCEED**

Dated: _____, 20____

To: _____
(Contractor)

Address: _____

CONTRACT FOR: **City of Berkeley Fire Warehouse Interior and Site Improvement Project AT
1011 Folger Avenue**

CONTRACT NO: XXXXXX

You are notified that the Contract Time under the above Contract will commence to run on _____ [20__]. On that date, you are to start performing your obligations with respect to Work at the Site under the Contract Documents. In accordance with Article 2 of Document 00 5200 (Agreement), the dates of Substantial Completion and Final Completion for the entire Work are _____, [20__] and _____, [20__], respectively.

Before you may start any Work at the Site, you must:

1. Submit certified Safety Program and related information
2. Submit copies of applicable permits
3. Submit approved fire protection plan, if applicable
4. **[Other]**

OWNER

By: _____

Its: _____

END OF DOCUMENT

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DOCUMENT 00 6113.13**CONSTRUCTION PERFORMANCE BOND**

KNOW ALL PERSONS BY THESE PRESENTS:

- 1.01** THAT WHEREAS, **City of Berkeley** ("City"), a public agency of the State of California, has awarded to _____ as Principal, Specification Number **24-11654-C**, dated the ___ day of _____, 20___ (the "Contract"), titled Fire Warehouse Interior and Site Improvement Project in the amount of _____, which Contract is by this reference made a part hereof, for the work of the following Contract:

(Describe Contract Work)

- 1.02** AND WHEREAS, Principal is required to furnish a bond in connection with the Contract, guaranteeing the faithful performance thereof;
- 1.03** NOW, THEREFORE, we, the undersigned Principal and **(Name of Surety)** _____ as Surety are held and firmly bound unto City in the sum of 100% OF THE CONTRACT PRICE to be paid to City or its successors and assigns; for which payment, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.
- 1.04** THE CONDITION OF THIS OBLIGATION IS SUCH, that if Principal, or its heirs, executors, administrators, successors, or assigns approved by City, shall promptly and faithfully perform the covenants, conditions, and agreements of the Contract during the original term and any extensions thereof as may be granted by City, with or without notice to Surety, and during the period of any guarantees or warranties required under the Contract, and shall also promptly and faithfully perform all the covenants, conditions, and agreements of any alteration of the Contract made as therein provided, notice of which alterations to Surety being hereby waived, on Principal's part to be kept and performed at the time and in the manner therein specified, and in all respects according to their true intent and meaning, and shall indemnify, defend, protect, and hold harmless City as stipulated in the Contract, then this obligation shall become and be null and void; otherwise it shall be and remain in full force and effect.
- 1.05** No extension of time, change, alteration, modification, or addition to the Contract, or of the work required thereunder, or work or actions by City to mitigate the damages resulting from any breach in performance by Contractor, shall release or exonerate Surety on this bond or in any way affect the obligation of this bond; and Surety does hereby waive notice of any such extension of time, change, alteration, modification, or addition.
- 1.06** Whenever Principal shall be and declared by City in default under the Contract, Surety shall promptly remedy the default, or shall promptly, and in no event later than thirty (30) calendar days from notice:
- A. Undertake through its agents or independent contractors (but having qualifications and experience reasonably acceptable to City, to complete the Contract in accordance with its terms and conditions and to pay and perform all obligations of Principal under the Contract, including without limitation, all obligations with respect to warranties, guarantees, indemnities, and the payment of liquidated damages; or
 - B. Obtain a bid or bids for completing the Contract in accordance with its terms and conditions, and, upon determination by City of the lowest responsible bidder, arrange for a contract between such bidder and City and make available as work progresses (even though there should be a default or a succession of defaults under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the Contract Sum, and to pay and perform all obligations of Principal under the Contract, including, without limitation, all obligations with respect to warranties, guarantees, and the payment of liquidated damages; but, in

any event, Surety's total obligations hereunder shall not exceed the amount set forth in the third paragraph hereof. The term "balance of the Contract Sum," as used in this paragraph, shall mean the total amount payable by City to the Principal under the Contract and any amendments thereto, less the amount paid by City to Principal.

- 1.07** Surety's obligations hereunder are independent of the obligations of any other surety for the performance of the Contract, and suit may be brought against Surety and such other sureties, jointly and severally, or against any one or more of them, or against less than all of them without impairing City's rights against the others.
- 1.08** Surety may not use Contractor to complete the Contract absent City's Consent. City shall have the right in its sole discretion to continue the work of the Contract, as necessary following a default and/or termination, as necessary to prevent risks of personal injury, property damage or delay to the Project.
- 1.09** No right of action shall accrue on this bond to or for the use of any person or corporation other than City or its successors or assigns.
- 1.10** Surety shall join in any proceedings brought under the Contract upon City's demand, and shall be bound by any judgment.
- 1.11** Correspondence or claims relating to this bond shall be sent to Surety at the address set forth below.

IN WITNESS WHEREOF, we have hereunto set our hands this _____ day of _____,
20_____.

CONTRACTOR AS PRINCIPAL

Company: (Corp. Seal)

Signature: _____

Name and Title: _____

Address: _____

_____**SURETY**

Company: (Corp. Seal)

Signature: _____

Name and Title: _____

Address: _____

_____**END OF DOCUMENT**

DOCUMENT 00 6113.16**CONSTRUCTION LABOR AND MATERIAL PAYMENT BOND**

KNOW ALL PERSONS BY THESE PRESENTS:

- 1.01** THAT WHEREAS, City of Berkeley ("City") has awarded to _____ as Principal, Specification No. **24-11654-C** dated the _____ day of _____, 20____ (the "Contract"), titled Fire Warehouse Interior and Site Improvement Project in the amount of _____, which Contract is by this reference made a part hereof, for the work of the following Contract:

(Describe Contract Work)

- 1.02** AND WHEREAS, Principal is required to furnish a bond in connection with the Contract to secure the payment of claims of laborers, mechanics, material suppliers, and other persons as provided by law;
- 1.03** NOW, THEREFORE, we, the undersigned Principal and (Name of Surety), as Surety, are held and firmly bound unto City in the sum of 100% OF THE CONTRACT PRICE (\$_____), for which payment well and truly to be made we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.
- 1.04** THE CONDITION OF THIS OBLIGATION IS SUCH, that if Principal, or its executors, administrators, successors, or assigns approved by City, or its subcontractors shall fail to pay any of the persons named in California Civil Code §3181, or amounts due under the State of California Unemployment Insurance Code with respect to work or labor performed under the Contract, or for any amounts required to be deducted, withheld, and paid over to the State of California Employment Development Department from the wages of employees of Principal and subcontractors pursuant to Section 13020 of the State of California Unemployment Insurance Code with respect to such work and labor, that Surety will pay for the same in an amount not exceeding the sum specified in this bond, plus reasonable attorneys' fees, otherwise the above obligation shall become and be null and void.
- 1.05** This bond shall inure to the benefit of any of the persons named in California Civil Code §3181, as to give a right of action to such persons or their assigns in any suit brought upon this bond. The intent of this bond is to comply with the California Mechanic's Lien Law.
- 1.06** Surety, for value received, hereby expressly agrees that no extension of time, change, modification, alteration, or addition to the undertakings, covenants, terms, conditions, and agreements of the Contract, or to the work to be performed thereunder, shall in any way affect the obligation of this bond; and it does hereby waive notice of any such extension of time, change, modification, alteration, or addition to the undertakings, covenants, terms, conditions, and agreements of the Contract, or to the work to be performed thereunder.
- 1.07** Surety's obligations hereunder are independent of the obligations of any other surety for the payment of claims of laborers, mechanics, material suppliers, and other persons in connection with Contract; and suit may be brought against Surety and such other sureties, jointly and severally, or against any one or more of them, or against less than all of them without impairing Owner's rights against the other.

1.08 Correspondence or claims relating to this bond shall be sent to Surety at the address set forth below.

IN WITNESS WHEREOF, we have hereunto set our hands this ____ day of _____, 20____.

CONTRACTOR AS PRINCIPAL

Company: (Corp. Seal)

Signature

Name

Title

Street Address

City, State, Zip Code

SURETY

Company: (Corp. Seal)

Signature

Name

Title

Street Address

City, State, Zip Code

END OF DOCUMENT

DOCUMENT 00 6290**ESCROW AGREEMENT FOR SECURITY DEPOSIT IN LIEU OF RETENTION**

California Public Contract Code §22300

THIS ESCROW AGREEMENT ("Escrow Agreement") is made and entered into this _____ day of _____, 20____, by and between City of Berkeley ("City"), whose address is 2180 Milvia Street, Berkeley, California 94704, _____ ("Contractor"), whose place of business is located at _____ and _____ (**Name**), as escrow agent OR [] (**Name of Bank**) _____, a state or federally chartered bank in the State of California, whose place of business is located at _____ ("Escrow Agent").

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

1. Pursuant to California Public Contract Code §22300, Contractor has the option to deposit securities with Escrow Agent as a substitute for retention earnings required to be withheld by City pursuant to Contract Number _____ entered into between City and Contractor for Fire Warehouse Interior and Site Improvement Project located at **1011 Folger Avenue** in the amount of _____ dated _____, 20____ (the "Contract"). Alternatively, on written request of Contractor, City shall make payments of the retention earnings directly to Escrow Agent. When Contractor deposits the securities as a substitute for Contract earnings, Escrow Agent shall notify City within ten calendar days of the deposit. The market value of the securities at the time of substitution shall be at least equal to the cash amount then required to be withheld as retention under terms of Contract between Owner and Contractor. Securities shall be held in name of _____, and shall designate Contractor as the beneficial owner.
2. City 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 in Paragraph 1 of this Document 00 6290.
3. When City makes payment(s) of retention earned directly to Escrow Agent, Escrow Agent shall hold said payment(s) 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 City 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 City. Such expenses and payment terms shall be determined by Owner, Contractor, and Escrow Agent.
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 City.
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 City to Escrow Agent that City consents to withdrawal of amount sought to be withdrawn by Contractor.
7. City shall have the right to draw upon the securities in event of default by Contractor. Upon seven (7) calendar days written notice to Escrow Agent from City of the default, Escrow Agent shall immediately convert the securities to cash and shall distribute the cash as instructed by City.
8. Upon receipt of written notification from City 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 moneys and securities on deposit and payments of fees and charges.

9. Escrow Agent shall rely on written notifications from City and Contractor pursuant to Paragraphs 5 through 8, inclusive, of this Document 00 6290 and City and Contractor shall hold Escrow Agent harmless from Escrow Agent's release and disbursement of securities and interest as set forth.
10. Names of persons who are authorized to give written notice or to receive written notice on behalf of City and on behalf of Contractor in connection with the foregoing, and exemplars of their respective signatures are as follows:

ON BEHALF OF CITY:

Title

Name

Signature

Address

City/State/Zip Code**ON BEHALF OF CONTRACTOR:**

Title

Name

Signature

Address

City/State/Zip Code**ON BEHALF OF ESCROW AGENT:**

Title

Name

Signature

Address

City/State/Zip Code

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

CITY

Title

Name

Signature**CONTRACTOR**

Title

Name

Signature

ATTEST

Signature

Print Name

City Clerk

ESCROW AGENT

Title

Print Name

Signature

Pre-approved as to form:
CITY ATTORNEY
8/2016

At the time the Escrow Account is opened, City and Contractor shall deliver to Escrow Agent a fully executed counterpart of this Document 00 6290.

END OF DOCUMENT

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DOCUMENT 00 6325**SUBSTITUTION REQUEST FORM**

To: _____, Project Manager, City of Berkeley]
 [(____) ____-____]

PROJECT: City's Specification No. :	Contractor:				
Substitution Request By:	Firm:				
Transmittal Record	Attn:	Firm:	Date Sent:	Date Rec'd:	Date Due:
Contractor to City					
Contractor to Architect					
City / Architect to Consultant					
Architect to City Representative					
City Representative to Contractor					

We hereby submit for your consideration the following product instead of the specified item for the Project:

Section / Drawing	Article	Specified Item
Proposed Substitution:		

We have (a) attached manufacturer's literature, including complete technical data and laboratory test results, if applicable, (b) attached an explanation of why proposed substitution is a true equivalent to specified item, (c) included complete information on changes to Contract Documents that the proposed substitution will require for its proper installation, and (d) filled in the blanks below:

Contractor to complete questions that follow and certifies to the accuracy of all answers:

A.	Does the substitution affect dimensions shown on Drawings? Yes ___ / No ___. If No, please explain proposed mitigation and why substitution is equivalent to originally specified item:
B.	Will the undersigned pay for changes to the building design, including engineering and detailing costs caused by the requested substitution? Yes ___ / No ___. If No, please state reasons explain why substitution is equivalent to originally specified item:
C.	What effect does the substitution have on other trades? No effect: ___ / Some effect___. If substitution will affect other trades, please explain the effect and why substitution is equivalent to originally specified item:
D.	Will substitution cause change to Project Schedule, or to critical delivery dates? Add? Shorten? If the substitution will add to schedule dates or affect critical activities, please explain why substitution is equivalent to originally specified item:
E.	Please describe differences between proposed substitution and specified item? Please explain and identify any and all differences, and please explain why substitution is equivalent to originally specified item:
F.	What is the Cost Differential to Contractor in original specified item and proposed substitution including all mark-ups? [If substitution requested during bid period, skip this question.]
G.	Are Manufacturer's guarantees for the proposed item the same as for item specified? Yes ____; No _____. If No, please explain why substitution is equivalent to originally specified item:

H. Contractor accepts full responsibility for delays caused by redesign of other items of the Work necessitated by substitution? Yes ___ / No ___. If No, please state reasons and explain why substitution is equivalent to originally specified item:

I. Contractor states that the function, appearance and quality are equivalent or superior to the specified item? Yes ___ / No ___. If No, please explain why substitution is equivalent to originally specified item:

We certify that the function, appearance, and quality of the proposed substitution are equivalent or superior to those of the specified item, except as we may specifically state otherwise in this request.

Submitted by: _____

Signature: _____

Firm: _____

Date: _____

Address: _____

Phone/ Fax: _____

Remarks: _____

Consultant Response: <input type="radio"/> Accepted <input type="radio"/> Not Accepted <input type="radio"/> Accepted As Noted <input type="radio"/> Received Too Late	City Representative Response: <input type="radio"/> Accepted <input type="radio"/> Not Accepted <input type="radio"/> Accepted As Noted <input type="radio"/> Received Too Late
---	--

Remarks: _____

Remarks: _____

By: _____

By: _____

END OF DOCUMENT

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DOCUMENT 00 6530**AGREEMENT AND RELEASE OF ANY AND ALL CLAIMS****[Public Contract Code § 7100]**

THIS AGREEMENT AND RELEASE OF ANY AND ALL CLAIMS ("Agreement and Release"), made and entered into this _____ day of _____, 20_____, by and between City of Berkeley ("City"), and _____ ("Contractor"), whose place of business is at
_____.

RECITALS

- A. City and Contractor entered into Contract Number **XXXXXX** (the "Contract") for construction of City **Fire Warehouse Interior and Site Improvement Project** located at **1011 Folger Avenue**, California.
- B. The Work under the Contract has been completed.

AGREEMENT

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

1. Contractor will not be assessed liquidated damages except as detailed below:

Original Contract Sum	\$ _____
Modified Contract Sum	\$ _____
Payment to Date	\$ _____
Liquidated Damages	\$ _____
Payment Due Contractor	\$ _____

2. Subject to the provisions of this Agreement and Release, Owner will forthwith pay to Contractor the sum of [_____ Dollars and _____ Cents (\$_____)] under the Contract, less any amounts withheld under the Contract or represented by any Notice to Withhold Funds on file with City as of the date of such payment.
3. Contractor acknowledges and hereby agrees that there are no unresolved or outstanding claims in dispute against City arising from the Contract, except for the claims described in Paragraph 4 of this Document 00 6530. 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 City, and all if its agents, employees, consultants, inspectors, representatives, assignees and transferees, except for the Disputed Claims set forth in Paragraph 4 of this Document 00 6530. Nothing in this Agreement and Release shall limit or modify Contractor's continuing obligations described in Paragraph 6 of this Document 00 6530.
4. The following claims submitted under Document 00 7200 (General Conditions), Article 12, are disputed (hereinafter, the "Disputed Claims") and are specifically excluded from the operation of this Agreement and Release.

[Insert information in Chart below, affix attachment if necessary]

CLAIM NO.	DATE SUBMITTED	DESCRIPTION OF CLAIM	AMOUNT OF CLAIM

5. Consistent with California Public Contract Code §7100, Contractor hereby agrees that, in consideration of the payment set forth in Paragraph 2 of this Document 00 6530, Contractor hereby releases and forever discharges City, and all of its agents, employees, consultants, 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, shall remain in full force and effect as specified in the Contract Documents.
7. Contractor shall immediately defend, indemnify and hold harmless City, any of the City's Representatives, Project Manager, and all of their agents, employees, consultants, inspectors, assignees and transferees, from any and all claims, demands, actions, causes of action, obligations, costs, expenses, damages, losses and liabilities that may be asserted against them by any of Contractor's suppliers and/or Subcontractors of any tier and/or any suppliers to them for any and all labor, materials, supplies and equipment used, or contemplated to be used in the performance of the Contract, except for the Disputed Claims set forth in Paragraph 4 of this Document 00 6530.
8. Contractor hereby waives the provisions of California Civil Code §1542, which provide as follows:

**A GENERAL RELEASE DOES NOT EXTEND TO CLAIMS WHICH
THE CREDITOR DOES NOT KNOW OR SUSPECT TO EXIST IN HIS
OR HER FAVOR AT THE TIME OF EXECUTING THE RELEASE,
WHICH IF KNOWN BY HIM OR HER, MUST HAVE MATERIALLY
AFFECTED HIS OR HER SETTLEMENT WITH THE DEBTOR.**

9. The provisions of this Agreement and Release are contractual in nature and not mere recitals and shall be considered independent and severable, and 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 regulation, then such provision, or part thereof shall remain in force and effect only 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.
10. Contractor represents and warrants that it is the true and lawful owner of all claims and other matters released pursuant to this Agreement and Release, and that it has full right, title and authority to enter into this instrument. Each party represents and warrants that it has been represented by counsel of its own choosing in connection with this Agreement and Release.
11. All rights of City shall survive completion of the Work or termination of the Contract, and execution of this Agreement and Release.

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

CITY

By: _____
Signature

Name: _____
Print

Its: _____
Title

ATTEST:

Title

Print

[CONTRACTOR]

By: _____
Signature

Name: _____
Print

Its: _____
Title

[CONTRACTOR]

By: _____
Signature

Name: _____
Print

Its: _____
Title

Pre-approved as to form:
CITY ATTORNEY
8/2016

END OF DOCUMENT

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DOCUMENT 00 6536**GUARANTY**

TO: The City of Berkeley ("City"), for construction of Fire Warehouse Interior and Site Improvement Project located at 1011 Folger Avenue, California.

The undersigned guarantees all construction performed on this Project and also guarantees all material and equipment incorporated therein.

Contractor hereby grants to City for a period of one year following the date of Final Acceptance of the Work completed, or such longer period specified in the Contract Documents, its unconditional warranty of the quality and adequacy of all of the Work including, without limitation, all labor, materials and equipment provided by Contractor and its Subcontractors of all tiers in connection with the Work.

Neither final payment nor use nor occupancy of the Work performed by the Contractor shall constitute an acceptance of Work not done in accordance with this Guaranty or relieve Contractor of liability in respect to any express warranties or responsibilities for faulty materials or workmanship. Contractor shall remedy any defects in the Work and pay for any damage resulting therefrom, which shall appear within one year, or longer if specified, from the date of Final Acceptance of the Work completed.

If within one year after the date of Final Acceptance of the Work completed, or such longer period of time as may be prescribed by laws or regulations, or by the terms of Contract Documents, any Work is found to be Defective, Contractor shall promptly, without cost to City and in accordance with City's written instructions, correct such Defective Work. Contractor shall remove any Defective Work rejected by City and replace it with Work that is not Defective, and satisfactorily correct or remove and replace any damage to other Work or the work of others resulting therefrom. If Contractor fails to promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, City may have the Defective Work corrected or the rejected Work removed and replaced. Contractor shall pay for all claims, costs, losses and damages caused by or resulting from such removal and replacement. Where Contractor fails to correct Defective Work, or defects are discovered outside the correction period, City shall have all rights and remedies granted by law.

Inspection of the Work shall not relieve Contractor of any of its obligations under the Contract Documents. Even though equipment, materials, or Work required to be provided under the Contract Documents have been inspected, accepted, and estimated for payment, Contractor shall, at its own expense, replace or repair any such equipment, material, or Work found to be Defective or otherwise not to comply with the requirements of the Contract Documents up to the end of the guaranty period.

All abbreviations and definitions of terms used in this Agreement shall have the meanings set forth in the Contract Documents.

The foregoing Guaranty is in addition to any other warranties of Contractor contained in the Contract Documents, and not in lieu of, any and all other liability imposed on Contractor under the Contract Documents and at law with respect to Contractor's duties, obligations, and performance under the Contract Documents. In the event of any conflict or inconsistency between the terms of this Guaranty and any warranty or obligation of the Contractor under the Contract Documents or at law, such inconsistency or conflict shall be resolved in favor of the higher level of obligation of the Contractor.

Date: _____, 20____

Contractor's name

By: _____

Signature

Print Name

Title

Street Address

City, State, Zip code

END OF DOCUMENT

DOCUMENT 00 6580**CITY OF BERKELEY CONTRACTING POLICIES**

Contractor shall comply with the City of Berkeley's adopted employment policies applying to City construction projects as described in Document 00 7317. The following certifications/forms shall be submitted in accordance with Document 00 2113 Instructions to Bidders:

- Memorandum of Understanding
- Workforce Composition Form
- Agreement for Change in Subcontractors
- Nuclear Free Zone Disclosure Form
- Oppressive States Compliance Statement
- Sanctuary City Compliance Certification
- Hardwood Disclosure Form
- ~~First Source Construction Agreement (for projects between \$100,000 and \$500,000)~~
- Community Workforce Agreement, Agreement to be Bound (for projects over \$500,000)
- Right to Audit Form
- Certification Of Compliance With Equal Benefits Ordinance
- Taxpayer Identification Report
- Contractor's License
- City of Berkeley Business License

**CITY OF BERKELEY
MEMORANDUM OF UNDERSTANDING
(MOU)**

1. The Contractor (and all Subcontractors) agree not to discriminate pursuant to City Ordinance No. 5876.
2. The Contractor agrees that he/she is also responsible for his/her Subcontractors' compliance with City of Berkeley Ordinance No. 5876.
3. For contracts over \$100,000, the Contractor agrees to comply with Ordinance No. 5876 as applied to the First Source Program (see Section 8 of Ordinance 5876).

The Contractor agrees to submit periodic employment and wage reports to the City's Contract Compliance Officer upon reasonable request.

Contractor

City of Berkeley Contracts Compliance Officer
Or his/her designee

Date

Date

CITY OF BERKELEY
WORKFORCE COMPOSITION FORM FOR ALL CONSTRUCTION CONTRACTS

This form is to be completed and submitted prior to the Contract Compliance Conference. The Contractor and all Subcontractors who will do work valued at \$3,000 or more are required to submit this form. Weekly payroll reports will be compared to this listing to monitor for compliance. A payroll printout or other listing of employees providing the same information will be accepted.

Name of Contractor/Subcontractor: _____

Project: _____

Name		Race*	Sex**	Trade/Craft	Basic Hourly Rate	Hire Date	Employees to be used on this job

* A=Asian or Pacific Islander **M = Male
 AI=American Indian **F = Female
 B=Afro American
 C=Caucasian
 H=Hispanic (Mexican, Puerto Rican,
 Spanish, Cuban, Chicano, Central
 or South American)
 8/91

Signature: _____ Date: _____
 Contractor/Subcontractor

Verified By: _____ Date: _____
 City of Berkeley Contracts Compliance Officer
 or his/her designee

**CITY OF BERKELEY
AGREEMENT FOR CHANGE IN SUB-CONTRACTORS**

I agree to use the Subcontractor(s) listed in the signed contract with the City of Berkeley. If it should become necessary to change Subcontractors, I will notify the Capital Projects Manager by completing the following information:

Current Subcontractor(s)	Alternate Subcontractors	Reason for Change	Date

Signed by:

Prime Contractor

Subcontractor

Verified by:

City of Berkeley Contracts Compliance Officer
Or his/her designee

Date: _____

Date: _____

Date: _____

CITY OF BERKELEY
NUCLEAR FREE ZONE DISCLOSURE FORM

I (we) certify that:

1. I am (we are) fully cognizant of any and all contracts held, products made or otherwise handled by this business entity, and of any such that are anticipated to be entered into, produced or handled for the duration of its contract(s) with the City of Berkeley. (To this end, this disclosure form may be signed by more than one individual, if a description of which type of contracts each individual is cognizant is attached.)

2. I (we) understand that Section 12.90.070 of the Nuclear Free Berkeley Act (Berkeley Municipal Code Ch. 12.90; Ordinance No. 5784-N.S.) prohibits the City of Berkeley from contracting with any person or business that knowingly engages in work for nuclear weapons.

3. I (we) understand the meaning of the following terms as set forth in Berkeley Municipal Code section 12.90.130:

"Work for nuclear weapons" is any work the purpose of which is the development, testing, production, maintenance or storage of nuclear weapons or the components of nuclear weapons; or any secret or classified research or evaluation of nuclear weapons; or any operation, management or administration of such work.

"Nuclear weapon" is any device, the intended explosion of which results from the energy released by reactions involving atomic nuclei, either fission or fusion or both. This definition of nuclear weapons includes the means of transporting, guiding, propelling or triggering the weapon if and only if such means is destroyed or rendered useless in the normal propelling, triggering, or detonation of the weapon.

"Component of a nuclear weapon" is any device, radioactive or non-radioactive, the primary intended function of which is to contribute to the operation of a nuclear weapon (or be a part of a nuclear weapon).

4. Neither this business entity nor its parent nor any of its subsidiaries engages in work for nuclear weapons or anticipates entering into such work for the duration of its contract(s) with the City of Berkeley.

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

Signed: _____

Date: _____

Printed Name and Title(s): _____

Company: _____

CITY OF BERKELEY**Oppressive States Compliance Statement for Personal Services**

The undersigned, an authorized agent of _____ (hereafter "Vendor"), has had an opportunity to review the requirements of Berkeley City Council Resolution Nos. 59,853-N.S., 60,382-N.S., and 70,606-N.S., (hereafter "Resolutions"). Vendor understands and agrees that the City may choose with whom it will maintain business relations and may refrain from contracting with those Business Entities which maintain business relationships with morally repugnant regimes. Vendor understands the meaning of the following terms used in the Resolutions:

"Business Entity" means "any individual, firm, partnership, corporation, association or any other commercial organization, including parent-entities and wholly-owned subsidiaries" (to the extent that their operations are related to the purpose of the contract with the City).

"Oppressive State" means: **Tibet Autonomous Region, the provinces of Ado, Kham, and U-Tsang; and Burma (Myanmar)**

"Personal Services" means "the performance of any work or labor and shall also include acting as an independent contractor or providing any consulting advice or assistance, or otherwise acting as an agent pursuant to a contractual relationship."

Contractor understands that it is not eligible to receive or retain a City contract if at the time the contract is executed, or at any time during the term of the contract it provides Personal Services to:

- a. The governing regime in any Oppressive State.
- b. Any business or corporation organized under the authority of the governing regime of any Oppressive State.
- c. Any person for the express purpose of assisting in business operations or trading with any public or private entity located in any Oppressive State.

Vendor further understands and agrees that Vendor's failure to comply with the Resolution shall constitute a default of the contract and the City Manager may terminate the contract and bar Vendor from bidding on future contracts with the City for five (5) years from the effective date of the contract termination.

The undersigned is familiar with, or has made a reasonable effort to become familiar with, Vendor's business structure and the geographic extent of its operations. By executing the Statement, Vendor certifies that it complies with the requirements of the Resolution and that if any time during the term of the contract it ceases to comply, Vendor will promptly notify the City Manager in writing.

Based on the foregoing, the undersigned declares under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Printed Name: _____ Title: _____

Signature: _____ Date: _____

Business Entity: _____

I am unable to execute this Statement; however, Vendor is exempt under Section VII of the Resolution. I have attached a separate statement explaining the reason(s) Vendor cannot comply and the basis for any requested exemption.

Signature: _____ Date: _____

Contract Description/Specification No.: Fire Warehouse Interior and Site Improvement Project/24-11654-C
Rev. 1/1/2023

CITY OF BERKELEY
Sanctuary City Compliance Statement

The undersigned, an authorized agent of _____ (hereafter "Contractor"), has had an opportunity to review the requirements of Berkeley Code Chapter 13.105 (hereafter "Sanctuary City Contracting Ordinance" or "SCCO"). Contractor understands and agrees that the City may choose with whom it will maintain business relations and may refrain from contracting with any person or entity that provides Data Broker or Extreme Vetting services to the U.S. Immigration and Customs Enforcement Division of the United States Department of Homeland Security ("ICE"). Contractor understands the meaning of the following terms used in the SCCO:

- a. "Data Broker" means either of the following:
 - i. The collection of information, including personal information about consumers, from a wide variety of sources for the purposes of reselling such information to their customers, which include both private-sector business and government agencies;
 - ii. The aggregation of data that was collected for another purpose from that for which it is ultimately used.
- b. "Extreme Vetting" means data mining, threat modeling, predictive risk analysis, or other similar services." Extreme Vetting does not include:
 - i. The City's computer-network health and performance tools;
 - ii. Cybersecurity capabilities, technologies and systems used by the City of Berkeley Department of Information Technology to predict, monitor for, prevent, and protect technology infrastructure and systems owned and operated by the City of Berkeley from potential cybersecurity events and cyber-forensic based investigations and prosecutions of illegal computer based activity.

Contractor understands that it is not eligible to receive or retain a City contract if at the time the Contract is executed, or at any time during the term of the Contract, it provides Data Broker or Extreme Vetting services to ICE.

Contractor further understands and agrees that Contractor's failure to comply with the SCCO shall constitute a material default of the Contract and the City Manager may terminate the Contract and bar Contractor from bidding on future contracts with the City for five (5) years from the effective date of the contract termination.

By executing this Statement, Contractor certifies that it complies with the requirements of the SCCO and that if any time during the term of the Contract it ceases to comply, Contractor will promptly notify the City Manager in writing. Any person or entity who knowingly or willingly supplies false information in violation of the SCCO shall be guilty of a misdemeanor and up to a \$1,000 fine.

Based on the foregoing, the undersigned declares under penalty of perjury under the laws of the State of California that the foregoing is true and correct. Executed this _____ day of ___, 20__, at _____, California.

Printed Name: _____ Title: _____

Signed: _____ Date: _____

Business Entity: _____

SCCO CompStmt (Oct2019)

CITY OF BERKELEY
HARDWOOD DISCLOSURE FORM
For use by vendors on contracts utilizing lumber

1. I understand that on December 12, 1995, the City Council directed staff not to purchase lumber from companies that purchase or sell wood or paper products that come from tropical rainforests. I understand that wood species with tropical origins include, but are not limited to: Apitong, Banak, Bocote, Bubinga, Cocobolo, Cordia, Ebony, Goncalo alves, Greenheart, Iroko, Jelutang, Koa, Luauan, Mahogany, Meranti, Padauk, Purpleheart, Ramin, Rosewood, Satinwood, Teak, Virola, Wenge, and Zebrawood.
2. I am knowledgeable about the wood and paper products purchased and sold by this company.
3. This company does not currently purchase or sell wood or paper products having their origins in tropical rainforests. In addition, this company will not, for the duration of its contract with the City of Berkeley, purchase or sell wood or paper products having their origins in tropical rainforests.

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

Signed: _____ Date: _____

Printed Name & Title: _____

Company: _____

I am unable to sign this disclosure form for the following reason(s):

FIRST SOURCE CONSTRUCTION AGREEMENT**EXHIBIT "A"**

First Source Construction Agreement

I certify that:

- I. I am authorized to enter into this agreement on behalf of the company whose name appears below ("Contractor").
- II. Contractor understands and agrees to comply with the City of Berkeley First Source Construction Agreement.
- III. **I choose Method One: check here _____**
 - A. Contractor understands that selecting Method One agreement with the City of Berkeley means that Contractor agrees as follows:
 1. To utilize the First Source Program Construction Employment Program as the first place for recruitment and referral of applicants for new and replacement workers.
 2. To allow the First Source Program a minimum of seventy-two (72) hours to refer applicants to Contractors. (Contractor may apply to the City of Berkeley for a waiver of the seventy-two hour requirement for an emergency situation.)
 3. To employ qualified applicants referred by the First Source Program.
 4. To fully document the reason(s) for not hiring persons referred by the First Source Program.
 5. To provide to the First Source Program, upon request, information on the employment status of First Source Program placements, and reason for separation if employee is terminated.
 - B. Should the First Source Program be unable to provide the employees needed, Contractor or subcontractor is relieved of its obligation to achieve the goals of the First Source Program.
 1. No documentation of "good Faith Effort Steps" would be required of Contractor and subcontractors
 2. No penalty would be assessed.
 - C. Contractor must go back to the First Source Program whenever its employment needs increase, to comply with the First Source Program.
 - D. Should Contractor or a listed subcontractor fail to comply with the First Source Program, Contractor shall be liable for liquidated damages in the amount of \$1,000 or 1% of the contract amount for each day of non-compliance. In addition, Contractor or listed subcontractor may be deemed a non-responsible bidder in connection with future City of Berkeley contracts.

IV. I choose Method Two: check here _____

- A. Should the contractor choose Method Two, Contractor can use any means of hiring Berkeley residents to achieve the goal. This also can include using union hiring halls requesting in writing for Berkeley residents. A copy must be sent to the First Source Program.
- B. Should Contractor or subcontractor fail to achieve the goals at any time during the course of this project, Contractor or listed subcontractor will be required to document compliance with each of the "good Faith Effort Steps" listed in the First Source Program description document.
- C. Should Contractor or a listed subcontractor fail to comply with the First Source Program, Contractor shall be liable for liquidated damages in the amount of \$1,000 or 1% of the contract amount for each day of non-compliance. In addition, Contractor or listed subcontractor may be deemed a non-responsible bidder in connection with future City of Berkeley contracts.

Company Name

Owner/Authorized Representative Signature

Address

Printed Name of Owner / Authorized Representative

Telephone Number

AGREEMENT TO BE BOUND

The undersigned, as a Contractor or Subcontractor ("Contractor") on a City Project ("Project"), for and in consideration of the award to it of a contract to perform work on said Project, and in further consideration of the mutual promises made in the Project's Community Workforce Agreement ("Agreement"), a copy which was received and is acknowledged, hereby:

1. Accepts and agrees to be bound by the terms and conditions of the Agreement, together with any and all amendments and supplements now existing or which are later made to said Agreement.
2. Certifies that it has no commitments or agreements which would preclude its full and complete compliance with the terms and conditions of said Agreement;
3. Agrees to secure from any Contractor (as defined in said Agreement) which is or becomes a subcontractor (or any tier) to it, and from any successors, a duly executed Agreement to be Bound in form identical to this document.
4. Contractor agrees that it shall be bound by all applicable trust agreements and plans for the provision of such fringe benefits as accrue to the direct benefit of the construction persons, including Health and Welfare, Pension, Training, Vacation, and/or other direct benefits provided pursuant to the appropriate craft agreement contained in Schedule "A" of Agreement.

Date: _____

Company Name: _____

Name of Prime Contractor or Higher Level Subcontractor:

Name of Project: _____

Signature: _____

Print Name: _____

Title: _____

Mailing Address: _____

Email Address: _____

Contractor's License #: _____

Motor Carrier Permit (CA) #: _____

CITY OF BERKELEY RIGHT TO AUDIT FORM

The Contractor agrees that pursuant to Section 61 of the Berkeley City Charter, the City Auditor's office may conduct an audit of Contractor's financial, performance and compliance records maintained in connection with the operations and services performed under this contract.

In the event of such audit, Contractor agrees to provide the Auditor with reasonable access to Contractor's employees and make all such financial, performance and compliance records available to the Auditor's office. City agrees to provide Contractor an opportunity to discuss and respond to any findings before a final audit report is filed.

Contractor's signature _____ Date: _____

Print Name and Title: _____

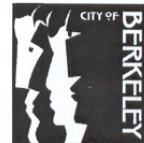
Company: _____

To be completed by
Contractor/Vendor

Form EBO-1
CITY OF BERKELEY

CERTIFICATION OF COMPLIANCE WITH EQUAL BENEFITS ORDINANCE

If you are a **contractor**, return this form to the originating department/project manager. If you are a **vendor** (supplier of goods), return this form to the Purchasing Division of the Finance Dept.



SECTION 1. CONTRACTOR/VENDOR INFORMATION

Name:	Vendor No.:		
Address:	City:	State:	ZIP:
Contact Person:	Telephone:		
E-mail Address:	Fax No.:		

SECTION 2. COMPLIANCE QUESTIONS

- A. The EBO is inapplicable to this contract because the contractor/vendor has no employees.
 Yes No (*If "Yes," proceed to Section 5; if "No," continue to the next question.*)
- B. Does your company provide (or make available at the employees' expense) any employee benefits?
 Yes No
 If "Yes," continue to Question C.
 If "No," proceed to Section 5. (The EBO is not applicable to you.)
- C. Does your company provide (or make available at the employees' expense) any benefits to the spouse of an employee? Yes No
- D. Does your company provide (or make available at the employees' expense) any benefits to the domestic partner of an employee? Yes No
If you answered "No" to both Questions C and D, proceed to Section 5. (The EBO is not applicable to this contract.)
If you answered "Yes" to both Questions C and D, please continue to Question E.
If you answered "Yes" to Question C and "No" to Question D, please continue to Section 3.
- E. Are the benefits that are available to the spouse of an employee identical to the benefits that are available to the domestic partner of the employee? Yes No
If you answered "Yes," proceed to Section 4. (You are in compliance with the EBO.)
If you answered "No," continue to Section 3.

SECTION 3. PROVISIONAL COMPLIANCE

- A. Contractor/vendor is not in compliance with the EBO now but will comply by the following date:
 - By the first effective date after the first open enrollment process following the contract start date, not to exceed two years, if the Contractor submits evidence of taking reasonable measures to comply with the EBO; or
 - At such time that administrative steps can be taken to incorporate nondiscrimination in benefits in the Contractor's infrastructure, not to exceed three months; or
 - Upon expiration of the contractor's current collective bargaining agreement(s).
- B. If you have taken all reasonable measures to comply with the EBO but are unable to do so, do you agree to provide employees with a cash equivalent?* Yes No

* The cash equivalent is the amount of money your company pays for spousal benefits that are unavailable for domestic partners.

SECTION 4. REQUIRED DOCUMENTATION

At time of issuance of purchase order or contract award, you may be required by the City to provide documentation (copy of employee handbook, eligibility statement from your plans, insurance provider statements, etc.) to verify that you do not discriminate in the provision of benefits.

SECTION 5. CERTIFICATION

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct and that I am authorized to bind this entity contractually. By signing this certification, I further agree to comply with all additional obligations of the Equal Benefits Ordinance that are set forth in the Berkeley Municipal Code and in the terms of the contract or purchase order with the City.

Executed this _____ day of _____, in the year _____, at _____,
(City) _____, (State)

Name (please print) _____

Signature _____

Title _____

Federal ID or Social Security Number _____

FOR CITY OF BERKELEY USE ONLY

- Non-Compliant (The City may not do business with this contractor/vendor)
 One-Person Contractor/Vendor Full Compliance Reasonable Measures
 Provisional Compliance Category, Full Compliance by Date: _____

Staff Name(*Sign and Print*): _____ Date: _____

TAXPAYER IDENTIFICATION REPORT

NAME/COMPANY'S NAME: _____

MAILING ADDRESS: _____

SOCIAL SECURITY NO.: _____

OR

EMPLOYER IDENTIFICATION NO.: _____

My Company is a Corporation []

My Company is not a Corporation []

I certify that the above information is true and correct:

(Signature)

(Title)

The Tax Equity and Fiscal Responsibility Act of 1982 (Public Law 97-248) requires the above reporting information be furnished to the City.

Persons who do not furnish their tax information numbers become subject to backup withholding by the City at a rate of 20% from each disbursement made to the recipient.

END OF DOCUMENT

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DOCUMENT 007200**GENERAL CONDITIONS**

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GENERAL CONDITIONS

ARTICLE 1 – INTERPRETATION OF CONTRACT DOCUMENTS

1.01 Interpretation Of Documents

- A. Contract Documents are complementary; what is called for by one is as binding as if called for by all.
- B. Individual Contract Documents subdivide at first level into Articles, and then into paragraphs.

1.02 Order Of Precedence Of Documents

- A. In the case of discrepancy or ambiguity in the Contract Documents, the following order of precedence shall prevail:
 1. Modifications in inverse chronological order (i.e., most recent first), and in the same order as specific portions they are modifying;
 2. Agreement Forms (Document 00 5200), and terms and conditions referenced therein;
 3. Supplementary General Conditions (Document 00 7201 et seq), if included;
 4. General Conditions (Document 00 7200);
 5. Division 1 Specifications, if included;
 6. Drawings and Technical Specifications (Division 2 and above);
 7. Written numbers over figures, unless obviously incorrect;
 8. Figured dimensions over scaled dimensions;
 9. Large-scale Drawings over small-scale Drawings.
- B. Any conflict between Drawings and Technical Specifications (Division 2 and above) will be resolved in favor of the document of the latest date (i.e., the most recent document), and if the dates are the same or not determinable, then in favor of Specifications.
- C. Any conflict between a bill or list of materials shown in the Contract Documents and the actual quantities required to complete Work required by Contract Documents, will be resolved in favor of the actual quantities.
- D. All Technical Specifications included in the Project manual shall be included within the Contract Documents unless identified otherwise.

ARTICLE 2 – PRE-BID INVESTIGATIONS

2.01 Pre-Bid Investigations Required

- A. Prior to and as a condition of submitting a Bid and executing Document 00 5200 (Agreement), Contractor shall make reasonable efforts to investigate fully the Work of the Contract. Contractor shall visit the Site, examine thoroughly and understand fully the nature and extent of the Contract Documents, Work, Site, locality, actual conditions and as-built conditions.
- B. Contractor's investigation shall include, without limitation, requesting and thoroughly examining of all reports of exploration and tests of subsurface conditions, as-built drawings, drawings, product specification(s) or reports, made available by City for contracting purposes or during Contractor's pre-bid investigations, of existing above ground and (to the extent applicable) below ground conditions (together, "Existing Conditions Data"), including, as applicable, Underground Facilities, geotechnical data, as-built data, utility surveys, record documents of all types, hazardous materials surveys, or similar materials which may appear or be referenced in the Project Manual or the in the Contract Documents, 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 which relate to any aspect of the means, methods, techniques, sequences or procedures of construction to be employed by Contractor and safety precautions and programs incident thereto.
- C. Contractor's investigations shall consider fully the fact that Existing Conditions Data is in many cases based on information furnished to City by others (e.g., the prior owner or builders), and that due to their age or their chain of custody since preparation, may not meet current industry standards for accuracy. Contractor shall also: (i.) provide City with prompt written notice of all

conflicts, errors, ambiguities, or discrepancies of any type, that it discovered in or among the Contract Documents and the Existing Conditions Data, and (ii.) subject to City's approval, conduct any such additional or supplementary examinations, investigations, explorations, tests, studies and data compilations, concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site or otherwise, which Contractor may deem necessary in order to perform and furnish the Work in accordance with the terms and conditions of Contract Documents.

- D. During performance of the Contract, Contractor will be charged with knowledge of all information that it should have learned in performing these pre-bid investigations and other obligations, and shall not be entitled to Change Orders (time or compensation) due to any information, error, inconsistency, omission, or conditions that Contractor should have known as a part of this Work. Contractor shall be responsible for the resultant losses, including, without limitation, the cost of correcting Defective Work.

2.02 Limited Reliance Permitted On City's Existing Conditions Data

- A. Regarding aboveground and as-built conditions shown on the Contract Documents or supplied by City, such information has been compiled in good faith, however, City does not expressly or impliedly warrant or represent that such information is correctly shown or indicated, or otherwise complete for construction purposes. Contractor must independently verify such information as part of its pre-bid investigations, and where conditions are not reasonably verifiable or discrepancies are identified, bring such matters to City's attention through written question issued during the bid period. In executing Document 00 5200 (Agreement), Contractor shall rely on the results of its own independent investigation and shall not rely on City-supplied information regarding aboveground conditions and as-built conditions, and Contractor shall accept full responsibility for its verification work sufficient to complete the Work as intended.
- B. Regarding subsurface conditions other than Underground Facilities shown on the Contract Documents or otherwise supplied by City, Contractor 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 in the Contract Documents. City is not responsible for the completeness of any subsurface condition information, Contractor's conclusions or opinions drawn from any subsurface condition information, or subsurface conditions that are not specifically shown. (For example, City is not responsible for soil conditions in areas contiguous to areas where a subsurface condition is shown.)

2.03 Pre-Bid Investigation Requirements For Excavation And Utilities Relocation Projects

- A. As part of its pre-bid investigations for Projects involving excavation and/or relocation of existing utilities, Contractor shall make reasonable efforts to verify information regarding Underground Facilities, including but not limited to, requesting additional information or verification of information as necessary.
- B. Because of the nature and location of City and the Project, the existence of Underground Facilities is deemed inherent in the Work of the Contract, as is the fact that Underground Facilities are not always accurately shown or completely shown on as-built records, both as to their depth and location. Contractor shall, therefore, take care to note the existence and potential existence of Underground Facilities, in particular, above and below grade structures, drainage lines, storm drains, sewers, water, gas, electrical, chemical, hot water, and other similar items and utilities. Contractor shall carefully consider all supplied information, request additional information Contractor may deem necessary, and visually inspect the Site for above ground indications of Underground Facilities (such as, for example not by way of limitation, the existence of existing service laterals, appurtenances or other types of utilities, indicated by the presence of an underground transmission main or other visible facilities, such as buildings, new asphalt, meters and junction boxes, on or adjacent to the Site). Contractor shall also consider local underground conditions and typical practices for Underground Facilities, either through its own direct knowledge or through its subcontractors, and fully consider this knowledge in assessing the existing information and the reasonableness of its reliance.

ARTICLE 3 – SUBCONTRACTORS

3.01 Subcontractor Listing Law

- A. Contractor shall comply with the Subcontractor Listing law, California Public Contract Code §§4101 et seq. Contractor shall not substitute any other person or firm in place of any Subcontractor listed in the Bid except as may be allowed by law.
- B. Subcontractors shall not assign or transfer their subcontracts or permit them to be performed by any other contractor without City's written approval. At City's request, Contractor shall provide City with a complete copy of all executed subcontracts or final commercial agreements with Subcontractors and/or suppliers.

3.02 Subcontracts

- A. Subcontract agreements shall preserve and protect the rights of City under the Contract Documents so that subcontracting will not prejudice such rights. To the extent of the Work to be performed by a Subcontractor, Contractor shall require the Subcontractor's written agreement (1) to be bound to the terms of Contract Documents and (2) to assume vis-à-vis Contractor all the obligations and responsibilities that Contractor assumes toward City under the Contract Documents. (These agreements include for example, and not by way of limitation, all warranties, claims procedures and rules governing submittals of all types to which Contractor is subject under the Contract Documents.)
- B. Contractor shall provide for the assignment to City of all rights any Subcontractor (of any tier) may have against any manufacturer, supplier, or distributor for breach of warranties and guarantees relating to the Work performed by the Subcontractor under the Contract Documents. Subcontracts shall provide and acknowledge City as an intended third-party beneficiary of each subcontract and supply contract (of any tier).

ARTICLE 4 – DRAWINGS AND SPECIFICATIONS

4.01 Intent Of Drawings And Specifications

- A. Contractor shall interpret words or phrases used to describe Work (including services), materials, or equipment that have well-known technical or construction industry or trade meaning in accordance with that meaning. Drawings' intent specifically includes the intent to depict construction that complies with all applicable laws, codes and standards.
- B. As part of the "Work," Contractor shall provide all labor, materials, equipment, machinery, tools, facilities, services, employee training and testing, hoisting facilities, Shop Drawings, storage, testing, security, transportation, disposal, the securing of all necessary or required field dimensions, the cutting or patching of existing materials, notices, permits, documents, reports, agreements and any other items required or necessary to timely and fully complete Work described and the results intended by Contract Documents and, in particular, Drawings and Specifications. Divisions and Specification Sections and the identification on any Drawings shall not control Contractor in dividing Work among Subcontractors or suppliers or delineating the Work to be performed by any specific trade.
- C. Contractor shall perform reasonably implied parts of Work as "incidental work" although absent from Drawings and Specifications. Incidental work includes any work not shown on Drawings or described in Specifications that is necessary or normally or customarily required as a part of the Work shown on Drawings or described in Specifications. Incidental work includes any work necessary or required to make each installation satisfactory, legally operable, functional, and consistent with the intent of Drawings and Specifications or the requirements of Contract Documents. Contractor shall perform incidental work without extra cost to City. Incidental work shall be treated as if fully described in Specifications and shown on Drawings, and the expense of incidental work shall be included in price Bid and Contract Sum.

4.02 Checking Of Drawings And Specifications

- A. Before undertaking each part of Work, Contractor shall carefully study and compare Contract Documents and check and verify pertinent figures shown in the Contract Documents and all

applicable field measurements. Contractor shall be responsible for any errors that might have been avoided by such comparison. Figures shown on Drawings shall be followed; Contractor shall not scale measurements. Contractor shall promptly report to City, in writing, any conflict, error, ambiguity or discrepancy that Contractor may discover. Contractor shall obtain a written interpretation or clarification from City before proceeding with any Work affected thereby. Contractor shall provide City with a follow-up correspondence every ten calendar days until it receives a satisfactory interpretation or clarification.

4.03 Interpretation Of Drawings And Specifications

- A. A typical or representative detail on Drawings shall constitute the standard for workmanship and material throughout corresponding parts of Work. Where necessary, and where reasonably inferable from Drawings, Contractor shall adapt such representative detail for application to such corresponding parts of Work. The details of such adaptation shall be subject to prior approval by City. Repetitive features shown in outline on Drawings shall be in exact accordance with corresponding features completely shown.
- B. Should any discrepancy appear or any misunderstanding arise as to the import of anything contained in Drawings and Specifications, or should Contractor have any questions or requests relating to Drawings or Specifications, Contractor shall refer the matter to City, in writing, with a copy to the Architect/Engineer. City will issue with reasonable promptness written responses, clarifications or interpretations as City may determine necessary, which shall be consistent with the intent of and be reasonably inferable from Contract Documents. Such written clarifications or interpretations shall be binding upon Contractor. If Contractor believes that a written response, clarification or interpretation justifies an adjustment in the Contract Sum or Contract Time, Contractor shall give City prompt written notice. If the parties are unable to agree to the amount or extent of the adjustment, if any, then Contractor shall perform the Work in conformance with City's response, clarification, or interpretation and may make a written claim for the adjustment as provided in Article 12.
- C. The following general specifications shall apply wherever in the Specifications, or in any directions given by City in accordance with or supplementing Specifications, it is provided that Contractor shall furnish materials or manufactured articles or shall do Work for which no detailed specifications are shown. Materials or manufactured articles shall be of the best grade, in quality and workmanship, obtainable in the market from firms of established good reputation. If not ordinarily carried in stock, the materials or manufactured articles shall conform to industry standards for first class materials or articles of the kind required, with due consideration of the use to which they are to be put. Work shall conform to the usual standards or codes, such as those cited herein, for first class work of the kind required. Contractor shall specify in writing to City the materials to be used or Work to be performed under this Paragraph ten Business Days prior to furnishing such materials or performing such Work.

4.04 Use Of Drawings And Specifications.

- A. Drawings, Specifications and other Contract Documents were prepared for use for Work of Contract Documents only. No part of Contract Documents shall be used for any other construction or for any other purpose except with the written consent of City. Any unauthorized use of Contract Documents is prohibited and at the sole liability of the user.

ARTICLE 5 – COMMENCEMENT OF THE WORK

5.01 Submission Of Required Schedules

- A. Contractor shall submit to City in draft for review and discussion at the Preconstruction Conference, and in final prior to the first payment application, the following schedules:
 1. Schedule of Values
 2. Progress Schedule, and
 3. Schedule of Submittals.
- B. No progress payment shall be due or owing to Contractor until such schedules are submitted to and acceptable to City and/or Architect/Engineer as meeting the requirements of the Contract

- Documents. In City's sole discretion, City may elect to instead withhold a portion of any progress payment for unacceptable compliance with contract requirements for such schedules.
- C. City's acceptance of Contractor's schedules will not create any duty of care or impose on City any responsibility for the sequencing, scheduling or progress of Work nor will it interfere with or relieve Contractor from Contractor's full responsibility therefore.

5.02 Commencement Date Of Contract Time

- A. The Contract Time will commence to run on the 60th Day after the issuance of the Notice of Award or, if a Notice to Proceed is given, on the date indicated in the Notice to Proceed.
- B. City may give a Notice to Proceed at any time within 60 calendar days after the Notice of Award. Contractor shall not do any Work at the Site prior to the date on which the Contract Time commences to run.

ARTICLE 6 – CONTRACTOR'S ORGANIZATION AND EQUIPMENT

6.01 Contractor's Legal Address

- A. Address and facsimile number given in Contractor's Bid are hereby designated as Contractor's legal address and facsimile number. Contractor may change its legal address and facsimile number by notice in writing, delivered to City, which in conspicuous language advises City of a change in legal address or facsimile number, and which City accepts in writing. Delivery to Contractor's legal address or depositing in any post office or post office box regularly maintained by the United States Postal Service, in a wrapper with postage affixed, directed to Contractor at legal address, or of any drawings, notice, letter or other communication, shall be deemed legal and sufficient service thereof upon Contractor. Facsimile to Contractor's designated facsimile number of any letter, memorandum, or other communication on standard or legal sized paper, with proof of facsimile transmission, shall be deemed legal and sufficient service thereof upon Contractor.

6.02 Contractor's Superintendents Or Forepersons

- A. Contractor shall at all times be represented on Site by one or more superintendents or forepersons authorized and competent to receive and carry out any instructions that City may give, and shall be liable for faithful observance of instructions delivered to Contractor or to authorized representative or representatives on Site.

6.03 Proficiency In English

- A. Supervisors, security guards, safety personnel and employees who have unescorted access to the Site shall possess proficiency in the English language in order to understand, receive and carry out oral and written communications or instructions relating to their job functions, including safety and security requirements.

6.04 Contractor's And Subcontractors' Employees

- A. Contractor shall employ, and shall permit its Subcontractors to employ, only competent and skillful personnel to do Work. If City notifies Contractor that any of its employees, or any of its Subcontractors' employees on Work is incompetent, unfaithful, disorderly or profane, or fails to observe customary standards of conduct or refuses to carry out any provision of the Contract Documents, or uses threatening or abusive language to any person on Work representing City, or violates sanitary rules, or is otherwise unsatisfactory, and if City requests that such person be discharged from Work, then Contractor or its Subcontractor shall immediately discharge such person from Work and the discharged person shall not be re-employed on the Work except with consent of City.

6.05 Contractor's Use Of The Site

- A. Contractor shall not make any arrangements with any person to permit occupancy or use of any land, structure or building within the limits of the Work, for any purpose whatsoever, either with or without compensation, in conflict with any agreement between City and any owner, former owner

or tenant of such land, structure or buildings. Contractor may not occupy City-owned property outside the limit of the Work as indicated on the Drawings unless it obtains prior approval from City.

6.06 Contractor's Site Office

- A. Unless expressly provided otherwise in the Contract Documents, Contractor shall provide a site office staffed by a resident project manager or job superintendent.

ARTICLE 7 – CITY'S ADMINISTRATION OF WORK

7.01 City's Representative(s)

- A. City's Representative(s) will have limited authority to act on behalf of City as set forth in the Contract Documents.
- B. Except as otherwise provided in these Contract Documents or subsequently identified in writing by City, City will issue all communications to Contractor through City's Representative, and Contractor shall issue all communications to City through City's Representative in a written document delivered to City.
- C. Should any direct communications between Contractor and City's consultants, architects or engineers not identified in Article 2 of Document 00 5200 (Agreement) occur during field visits or by telephone, Contractor shall immediately confirm them in a written document copied to City.

7.02 City's Observation Of The Work

- A. Work shall be performed under City's general observation and administration. Contractor shall comply with City's directions and instructions in accordance with the terms of Contract Documents, but nothing contained in these General Conditions shall be taken to relieve Contractor of any obligations or liabilities under the Contract Documents. City's failure to review or, upon review, failure to object to any aspect of Work reviewed, shall not be deemed a waiver or approval of any non-conforming aspect of Work.
- B. Subject to those rights specifically reserved in the Contract Documents, City will not supervise, or direct, or have control over, or be responsible for, Contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or Contractor's failure to comply with laws and regulations applicable to the furnishing or performance of Work. City will not be responsible for Contractor's failure to perform or furnish the Work in accordance with Contract Documents.

7.03 Architect/Engineer's Observation Of Work

- A. City may engage an Architect/Engineer, an independent consultant or Project Manager (collectively for purposes of this Paragraph, "Project Manager/Architect") to assist in administering the Work. If so engaged, Project Manager/Architect will advise and consult with City, but will have authority to act on behalf of City only to extent provided in the Contract Documents or as set forth in writing by City. Project Manager/Architect will not be responsible for and will not have control or charge of construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with Work. Project Manager/Architect will not be responsible for or have control over the acts or omissions of Contractor, Subcontractors or their agents or employees, or any other persons performing Work.
- B. Project Manager/Architect may review Contractor's Submittals, such as Shop Drawings, Product Data, and Samples, but only for conformance with design concept of Work and with information given in the Contract Documents.
- C. Project Manager/Architect may visit the Site at intervals appropriate to stage of construction to become familiar generally with the progress and quality of Work and to determine in general if Work is proceeding in accordance with Contract Documents. Based on its observations, Project Manager/Architect may recommend to City that it disapproves or rejects Work that Project Manager/Architect believes to be Defective or will not produce a complete Project that conforms to Contract Documents or will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by Contract Documents. City will also have authority

to require special inspection or testing of Work, whether or not the Work is fabricated, installed or completed.

- D. Project Manager/Architect may conduct inspections to recommend to City the dates that Contractor has achieved Substantial Completion and Final Acceptance, and will receive and forward to City for review written warranties and related documents required by Contract Documents.

7.04 Owner's And Architect/Engineer's Exercise Of Contract Responsibilities

- A. City, Project Manager, Architect/Engineer and all City's representatives, in performing their duties and responsibilities under the Contract Documents, accept no duties, responsibilities or duty of care, nor may the same be implied or inferred, towards Contractor, any Subcontractor, sub-Subcontractor or supplier, except those set forth expressly in the Contract Documents.

7.05 City's Right Of Access To The Work

- A. During performance of Work, City and its agents, consultants, and employees may at any time enter upon Work, shops or studios where any part of the Work may be in preparation, or factories where any materials for use in Work are being or are to be manufactured, and Contractor shall provide proper and safe facilities for this purpose, and shall make arrangements with manufacturers to facilitate inspection of their processes and products to such extent as City's interests may require. Other contractors performing work for City may also enter upon Work for all purposes required by their respective contracts. Subject to the rights reserved in the Contract Documents, Contractor shall have sole care, custody, and control of the Site and its Work areas.

7.06 City's Right Of Separate Construction

- A. City may perform with its own forces, construction or operations related to the Project, or the Site during Contractor's operations. City may also award separate contracts in connection with other portions of the Project or other construction or operations, on the Site or areas contiguous to the Site, under conditions similar to these Contract Documents, or may have utility owners perform other work.
- B. Contractor shall adjust its schedule and fully coordinate with and shall afford all other contractors, utility districts and City (if City is performing work with its own forces), proper and safe access to the Site, and reasonable opportunity for the installation and storage of their materials. Contractor shall ensure that the execution of its Work properly connects and coordinates with others' work, do all cutting, fitting and patching of the Work that may be required to make its several parts come together properly and integrate with such other work, and shall cooperate with them to facilitate the progress of the Work.
- C. To the extent that any part of Contractor's Work is to interface with work performed or installed by other contractors or utility owners, Contractor shall inspect and measure the in-place work. Contractor shall promptly report to City in writing any defect in in-place work that will impede or increase the cost of Contractor's interface unless corrected.

ARTICLE 8 – CONTRACTOR'S PROSECUTION AND PROGRESS OF THE WORK

8.01 Contractor To Supervise The Work

- A. Subject to those rights specifically reserved in the Contract Documents, Contractor shall supervise, direct, have control over, and be responsible for, Contractor's means, methods, techniques, sequences or procedures of construction, safety precautions and programs incident thereto, and compliance with laws and regulations applicable to the furnishing or performance of Work.
- B. Contractor shall keep on the Site at all times during Work progress a competent resident Superintendent, who shall not be replaced without City's express written consent. The Superintendent shall be Contractor's representative at the Site and shall have complete authority to act on behalf of Contractor. All communications to and from the Superintendent shall be as binding as if given to or by Contractor.
- C. Contractor shall supervise, inspect, and direct Work competently and efficiently, devoting the

attention and applying such personal skills and expertise as may be required and necessary to perform Work in accordance with Contract Documents. Contractor shall be solely responsible for and have control and charge of construction means, methods, techniques, sequences and procedures, safety precautions and programs in connection with the Work. Contractor shall be responsible to see that the completed Work complies accurately with Contract Documents.

- D. Contractor is fully responsible for Contractor's own acts and omissions. Contractor is responsible for all acts and omissions of its Subcontractors, suppliers, and other persons and organizations performing or furnishing any of the Work, labor, materials, or equipment under a direct or indirect contract with Contractor.
- E. Contractor shall conduct monthly Contractor Safety Committee meetings, and weekly toolbox safety talks.

8.02 Contractor To Maintain Cost Data

- A. Contractor shall maintain full and correct information as to the number of workers employed in connection with each subdivision of Work, the classification and rate of pay of each worker in form of certified payrolls, the cost to Contractor of each class of materials, tools and appliances used by Contractor in Work, and the amount of each class of materials used in each subdivision of Work. Contractor shall provide City with monthly summaries of this information. If Contractor maintains or is capable of generating summaries or reports comparing actual Project costs with Bid estimates or budgets, Contractor shall provide City with a copy of such report upon City's request.
- B. Contractor shall maintain daily job reports recording all significant activity on the job, including the number of workers on Site, Work activities, problems encountered and delays. Contractor shall provide City with copies for each Day Contractor works on the Project, to be delivered to City either the same Day or the following morning before starting work at the Site. Contractor shall take pre-construction and monthly progress photographs of all areas of the Work. Contractor shall maintain copies of all correspondence with Subcontractors and records of meetings with Subcontractors.
- C. City shall have the right to audit and copy Contractor's books and records of any type, nature or description relating to the Project (including but not limited to financial records reflecting in any way costs claimed on the Project), and to inspect the Site, including Contractor's trailer, or other job Site office, and this requirement shall be contained in the subcontracts of Subcontractors working on Site. By way of example, City shall have the right to inspect and obtain copies of all Contract Documents, planning and design documents, Bid proposal and negotiation documents, cost records and job cost variance reports, design modification proposals, value engineering or other cost reduction proposals, revisions made to the original design, job progress reports, photographs, and as-built drawings maintained by Contractor. City and any other applicable governmental entity shall have the right to inspect all information and documents maintained hereunder at any time during the Project and for a period of five years following Final Completion, in accordance with the provisions of Section 8546.7 of the California Government Code. This right of inspection shall not relieve Contractor of its duties and obligations under the Contract Documents. This right of inspection shall be specifically enforceable in a court of law, either independently or in conjunction with enforcement of any other rights in the Contract Documents.

8.03 Contractor To Supply Sufficient Workers And Materials

- A. Unless otherwise required by City under the terms of Contract Documents, Contractor shall at all times keep on the Site materials and employ qualified workers sufficient to prosecute Work at a rate and in a sequence and manner necessary to complete Work within the Contract Time. This obligation shall remain in full force and effect notwithstanding disputes or claims of any type.
- B. At any time during progress of Work should Contractor directly or indirectly (through Subcontractors) refuse, neglect, or be unable to supply sufficient materials or employ qualified workers to prosecute the Work as required, then City may require Contractor to accelerate the Work and/or furnish additional qualified workers or materials as City may consider necessary, at no cost to City. If Contractor does not comply with the notice within three Business Days of date of service thereof, City shall have the right (but not a duty) to provide materials and qualified

workers to finish the Work or any affected portion of Work, as City may elect. City may, at its discretion, exclude Contractor from the Site, or portions of the Site or separate work elements during the time period that City exercises this right. City will deduct from moneys due or which may thereafter become due under the Contract Documents, the sums necessary to meet expenses thereby incurred and paid to persons supplying materials and doing Work. City will deduct from funds or appropriations set aside for purposes of Contract Documents the amount of such payments and charge them to Contractor as if paid to Contractor. Contractor shall remain liable for resulting delay, including liquidated damages and indemnification of City from claims of others.

- C. Exercise by City of the rights conferred upon City in this subparagraph is entirely discretionary on the part of City. City shall have no duty or obligation to exercise the rights referred to in this subparagraph and its failure to exercise such rights shall not be deemed an approval of existing Work progress or a waiver or limitation of City's right to exercise such rights in other concurrent or future similar circumstances. (The rights conferred upon City under this subparagraph are, like all other such rights, cumulative to City's other rights under any provision of the Contract Documents.)

8.04 Contractor To Maintain Project Record Documents

- A. Contractor shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Contract Modifications, Change Orders, Work Directives, Force Account orders, and written interpretations and clarifications in good order and annotated to show all as-built changes made during construction. These Project Record Documents, together with all approved Samples and a counterpart of all approved Shop Drawings, shall be maintained and available to City for reference. Upon completion of the Work, Contractor shall deliver to City, the Project Record Documents, Samples and Shop Drawings and as-built drawings.
- B. Throughout Contractor's performance of the Work of the Project, Contractor shall maintain construction records to include: shop drawings; product data/material data sheets; samples; submittal; purchases; materials; equipment; inspections; applicable handbooks; applicable codes and standards; maintenance and operating manuals and instructions; RFI Log; Submittal Log; other related documents and revisions which arise out of the Construction Contracts. Contractor shall maintain records of principal building layout lines, elevations for the bottom of footings, floor levels, and key site elevations (certified by a qualified surveyor or professional engineer). Contractor shall make all records available to City. At the completion of the Project, Contractor shall deliver all such records to the City to have a complete set of record as-built drawings.

8.05 Contractor To Not Disrupt City Operation

- A. Contractor shall schedule and execute all Work in a manner that does not interfere with or disrupt City operations, including but not limited to, parking, utilities (electricity, gas, water), noise, access by employees and administration, access by vendors, physicians, patients and any other person or entity using City facilities or doing business with City. Contractor shall produce and supply coordination plans and requests to City, following City procedures, for all necessary interference of construction with City, which City will reasonably cooperate with.

8.06 Contractor To Provide Temporary Facilities And Controls

- A. Unless expressly provided otherwise in the Contract Documents, Contractor shall provide all temporary utilities (including without limitation electricity, water, natural gas), lighting, heating, cooling and ventilating devices, telephone, sanitary facilities, barriers, fences and enclosures, tree and plant protection, fire protection, pollution, erosion, Storm Water Pollution Prevention controls, noise and traffic control, and any other necessary services required for construction, testing or completion of the Work.

ARTICLE 9 – WARRANTY, GUARANTY, AND INSPECTION OF WORK

9.01 Warranty And Guaranty

- A. General Representations and Warranties: Contractor represents and warrants that it is and will

be at all times fully qualified and capable of performing every Phase of the Work and to complete Work in accordance with the terms of Contract Documents. Contractor warrants that all construction services shall be performed in accordance with generally accepted professional standards of good and sound construction practices and all requirements of Contract Documents. Contractor warrants that Work, including but not limited to each item of materials and equipment incorporated therein, shall be new, of suitable grade of its respective kind for its intended use, and free from defects in design, engineering, materials, construction and workmanship.

Contractor warrants that Work shall conform in all respects with all applicable requirements of federal, state and local laws, applicable construction codes and standards, licenses, and permits, Drawings and Specifications and all descriptions set forth therein, and all other requirements of Contract Documents. Contractor shall not be responsible, however, for the negligence of others in the specification of specific equipment, materials, design parameters and means or methods of construction where that is specifically shown and expressly required by Contract Documents.

- B. Extended Guarantees: Any guarantee exceeding one year provided by the supplier or manufacturer of any equipment or materials used in the Project shall be extended for such term. Contractor expressly agrees to act as co-guarantor of such equipment and materials and shall supply City with all warranty and guarantee documents relative to equipment and materials incorporated in the Project and guaranteed by their suppliers or manufacturers.
- C. Environmental and Toxics Warranty: The covenants, warranties and representations contained in this Paragraph are effective continuously during Contractor's Work on the Project and following cessation of labor for any reason including, but not limited to, Project completion. Contractor covenants, warrants and represents to City that:
 - 1. To Contractor's knowledge after due inquiry, no lead or Asbestos-containing materials were installed or discovered in the Project at any time during Contractor's construction thereof. If any lead or Asbestos-containing materials were discovered, Contractor made immediate written disclosure to City.
 - 2. To Contractor's knowledge after due inquiry, no electrical transformers, light fixtures with ballasts or other equipment containing PCBs are or were located on the Project at any time during Contractor's construction thereof.
 - 3. To Contractor's knowledge after due inquiry, no storage tanks for gasoline or any other toxic substance are or were located on the Project at any time during Contractor's construction thereof. If any such materials were discovered, Contractor made immediate written disclosure to City.
 - 4. Contractor's operations concerning the Project are and were not in violation of any applicable environmental federal, state, or local statute, law or regulation dealing with hazardous materials substances or toxic substances and no notice from any governmental body has been served upon Contractor claiming any violation of any such law, ordinance, code or regulation, or requiring or calling attention to the need for any Work, repairs, construction, alteration, or installation on or in connection with the Project in order to comply with any such laws, ordinances, codes, or regulations, with which Contractor has not complied. If there are any such notices with which Contractor has complied, Contractor shall provide City with copies thereof.

9.02 Inspection Of Work

- A. Work and materials, and manufacture and preparation of materials, from beginning of construction until Final Completion and acceptance of Work, shall be subject to inspection and rejection by City, its agents, representatives or independent contractors retained by City to perform inspection services, or governmental agencies with jurisdictional interests. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's Site safety procedures and program so that they may comply therewith as applicable. Upon request or where specified, City shall be afforded access for inspection at the source of supply, manufacture or assembly of any item of material or equipment, with reasonable accommodations supplied for making such inspections.
- B. Contractor shall furnish, in such quantities and sizes as may be required for proper examination and tests, Samples or test specimens of all materials to be used or offered for use in connection

with Work. Contractor shall prepare Samples or test specimens at its expense and furnish them to City. Contractor shall submit all Samples in ample time to enable City to make any necessary tests, examinations, or analyses before the time it is desired to incorporate the material into the Work.

- C. Contractor shall give City timely notice of readiness of Work for all required inspections, tests or approvals, and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.
- D. If applicable laws or regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests or approvals, and furnish City with the required certificates of inspection, or approval. City will pay the cost of initial testing and Contractor shall pay all costs in connection with any follow-up or additional testing. Contractor shall also be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests or approvals required for the acceptance of materials or equipment to be incorporated in the Work, or of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.
- E. If Contractor covers any Work, or the work of others, prior to any required inspection, test or approval without written approval of City, Contractor shall uncover the Work at City's request. Contractor shall bear the expense of uncovering Work and replacing Work. In any case where Contractor covers Work contrary to City's request, Contractor shall uncover Work for City's observation or inspection at City's request. Contractor shall bear the cost of uncovering Work.
- F. Whenever required by City, Contractor shall furnish tools, labor and materials necessary to make examination of Work that may be completed or in progress, even to extent of uncovering or taking down portions of finished Work. Should Work be found unsatisfactory, cost of making examination and of reconstruction shall be borne by Contractor. If Work is found to be satisfactory, City, in manner herein prescribed for paying for alterations, Modifications, and extra Work, except as otherwise herein specified, will pay for examination.
- G. Inspection of the Work by or on behalf of City, or City's failure to do so, shall not under any circumstances be deemed a waiver or approval of any non-conforming aspect of the Work. Contractor shall have an absolute duty, in the absence of a written Change Order signed by City, to perform Work in conformance with the Contract Documents and to immediately correct Defective Work immediately upon Contractor's knowledge.
- H. Any inspection, evaluation, or test performed by or on behalf of City relating to the Work is solely for the benefit of City, and shall not be relied upon by Contractor. Contractor shall not be relieved of the obligation to perform Work in accordance with the Contract Documents, nor relieved of any guaranty, warranty, or other obligation, as a result of any inspections, evaluations, or tests performed by City, whether or not such inspections, evaluations, or tests are permitted or required under the Contract Documents. Contractor shall be solely responsible for testing and inspecting Work already performed to determine whether such Work is in proper condition to receive later Work.

9.03 Correction Of Defective Work

- A. City may direct Contractor to correct any Defective Work or remove it from the Site and replace it with Work that is not Defective and satisfactorily correct or remove and replace any damage to other Work or the work of others resulting from the correction or removal. Contractor shall be responsible for any and all claims, costs, losses and damages caused by or resulting from such correction or removal. A Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work and the Contract Sum. If the parties are unable to agree to the amount of an appropriate decrease in the Contract Sum, City may decide the proper amount or, in its discretion may elect to leave the Contract Sum unchanged and deduct from monies due Contractor, all such claims, costs, losses and damages caused by or resulting from the correction or removal. If Contractor disagrees with City's calculations, it may make a claim as provided in Article 12 of this Document 00 7200. City's rights under this Paragraph shall be in addition to any other rights it may have under the Contract Documents or by law.

- B. If Contractor fails to supply sufficient skilled workers, suitable materials or equipment, or to furnish or perform the Work in such a way that the completed Work will conform to Contract Documents, City may order Contractor to replace any such Defective Work, or stop any portion of Work to permit City (at Contractor's expense) to replace such Defective Work. These City rights are entirely discretionary on the part of City, and shall not give rise to any duty on the part of City to exercise the rights for the benefit of Contractor or any other party.

9.04 Acceptance And Correction Of Defective Work By City

- A. City may in its sole discretion elect to accept Defective Work. Contractor shall pay all claims, costs, losses and damages attributable to City's evaluation of and determination to accept such Defective Work. If City accepts any Defective Work prior to final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work and the Contract Sum. If the parties are unable to agree to the amount of an appropriate decrease in the Contract Sum, City may deduct from monies due Contractor, all claims, costs, losses, damages, expenses and liabilities attributable to the Defective Work. If Contractor disagrees with City's calculations, Contractor may make a claim as provided in Article 12 of this Document 00 7200. If City accepts any Defective Work after final payment, Contractor shall pay to City, an appropriate amount as determined by City.
- B. City may correct and remedy deficiency if, after five calendar days' written notice to Contractor, Contractor fails to correct Defective Work or to remove and replace rejected Work; or provide a plan for correction of Defective Work acceptable to City; or perform Work in accordance with Contract Documents. In connection with such corrective and remedial action, City may exclude Contractor from all or part of the Site; take possession of all or part of Work and suspend Contractor's Work related thereto; take possession of all or part of Contractor's tools, appliances, construction equipment and machinery at the Site; and incorporate in Work any materials and equipment stored at the Site or for which City has paid Contractor but which are stored elsewhere. Contractor shall allow City, its representatives, agents, employees, and other contractors and Project Manager/Architect's consultants' access to the Site to enable City to exercise the rights and remedies under this Paragraph. Contractor shall be responsible for all claims, costs, losses, damages, expenses and liabilities incurred or sustained by City in exercising such rights and remedies. A Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to Work and the Contract Sum. If the parties are unable to agree to the amount of an appropriate decrease in the Contract Sum, City may deduct from moneys due Contractor, all claims, costs, losses and damages caused by or resulting from the correction or removal. If Contractor disagrees with City's calculations, Contractor may make a claim as provided in Article 12.

9.05 Rights Upon Inspection, Correction Or Acceptance

- A. Contractor shall not be allowed an extension of Contract Time because of any delay in the performance of Work attributable to the exercise by City of its rights and remedies under this Article. Where City exercises its rights under this Article, it retains and may still exercise all other rights it has by law or under the Contract Documents including, but not limited to, the right to terminate Contractor's right to proceed with the Work under the Contract Documents for cause and/or make a claim or back charge where a Change Order cannot be agreed upon.
- B. Inspection by City or its authorized agents or representatives shall not relieve Contractor of its obligation to have furnished material and workmanship in accordance with Contract Documents. Payment for Work completed through periodic progress payments, final payment or otherwise shall not operate to waive City's right to require full compliance with Contract Documents and shall in no way be deemed as acceptance of any defective Work paid therefor. Contractor's obligation to complete the Work in accordance with Contract Documents shall be absolute, unless City agrees otherwise in writing.

9.06 Proof Of Compliance Of Contract Provisions

- A. In order that City may determine whether Contractor has complied or is complying with requirements of Contract Documents not readily enforceable through inspection and tests of

Work and materials, Contractor shall at any time, when requested, submit to City properly authenticated documents or other satisfactory proofs of compliance with all applicable requirements.

- B. Before commencing any portion of Work, Contractor shall inform City in writing as to time and place at which Contractor wishes to commence Work, and nature of Work to be done, in order that proper provision for inspection of Work may occur, and to assure measurements necessary for record and payment. Information shall be given to City a reasonable time in advance of time at which Contractor proposes to begin Work, so that City may complete necessary preliminary work without inconvenience or delay to Contractor.

9.07 Correction Period And Project Warranty Period:

- A. If within one year after the date of Final Acceptance, or such longer period of time as may be prescribed by laws, regulations or by the terms of Contract Documents or any extended warranty or guaranty, any Work (completed or incomplete) is found to be Defective, Contractor shall promptly without cost to City and in accordance with City's written instructions, correct such Defective Work. Contractor shall remove any Defective Work rejected by City and replace it with Work that is not Defective, and satisfactorily correct or remove and replace any damage to other Work or the work of others resulting therefrom. If Contractor fails to promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, City may have the Defective Work corrected or the rejected Work removed and replaced. Contractor shall pay for all claims, costs, losses and damages caused by or resulting from such removal and replacement. Where Contractor fails to correct Defective Work, or defects are discovered outside the correction period, City shall have all rights and remedies granted by law.
- B. In special circumstances where a part of the Work is occupied or a particular item of equipment is placed in continuous service before Final Acceptance of all the Work, the correction period for that part of Work or that item may start to run from an earlier date if so provided by Change Order.
- C. Where Defective Work or rejected Work (and damage to other Work resulting therefrom) has been corrected, removed, or replaced under this provision after the commencement of the correction period, the correction period hereunder with respect to such Work shall be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

9.08 No Waiver

- A. Neither recordation of Final Acceptance nor final certificate for payment nor provision of the Contract nor partial or entire use or occupancy of premises by City shall constitute acceptance of Work not done in accordance with Contract Documents nor relieve Contractor of liability in respect to express warranties or responsibility for faulty materials or workmanship.
- B. If, after installation, operation, or use of materials or equipment to be provided under Contract proves to be unsatisfactory to City, City shall have right to operate and use materials or equipment until said materials and equipment can, without damage to City, be taken out of service for correction or replacement. Period of use of Defective materials or equipment pending correction or replacement shall in no way decrease guarantee period required for acceptable corrected or replaced items of materials or equipment.
- C. Nothing in the Contract Documents shall be construed to limit, relieve, or release Contractor's, Subcontractors', and equipment suppliers' liability to City for damages sustained as result of latent defects in materials or equipment caused by negligence of Contractor, its agents, suppliers, employees, or Subcontractors.

ARTICLE 10 – MODIFICATIONS OF CONTRACT DOCUMENTS

10.01 City's Right To Direct Changed Work.

- A. City may, without notice to the sureties and without invalidating the Contract, make changes in the Work ("Changed Work"), including without limitation: alterations, deviations, additions to, or

deletions from Contract Documents; increase or decrease the quantity of any item or portion of the Work; expand, reduce or otherwise change the Contract Time; delete any item or portion of the Work; and require extra Work. Contractor shall perform such Work under applicable provisions of the Contract Documents, unless specifically provided otherwise at the time the change is ordered. In the case of any ordered extra Work, City reserves the right to furnish all or portions of associated labor, material, and equipment, which Contractor shall accept and use without payment for costs, markup, profit, or otherwise for such City-furnished labor, materials, and equipment.

- B. If Changed Work is of such a nature as to increase or decrease the time or cost of any part of Work, price fixed in Contract shall be increased or decreased by amount as the Contractor and City may agree upon as reasonable and proper allowance for increase or decrease in cost of Work using the cost guidelines set forth in this Article, and absent such agreement, then as City may direct (with Contractor retaining its rights under Article 12 herein).

10.02 Required Documentation For Changed Work

- A. Changes affecting the Contract Time or Contract Sum of the Work shall be set forth in a written Change Order or Change Directive that shall specify:
1. The Work performed in connection with the change to be made;
 2. The amount of the adjustment of the Contract Sum, if any, and the basis for compensation for the Work ordered; and
 3. The extent of the adjustment in the Contract Time, if any.
- B. A Change Order or Change Directive will become effective when signed by City, notwithstanding that Contractor has not signed it. A Change Order will become effective without Contractor's signature, provided City indicates same thereon (by indicating it as a "unilateral change order").
- C. All changes in any plans and specifications approved by any authority with jurisdiction may also require addenda or change orders approved by that authority.
- D. Where City requests, a performance bond rider covering the changed Work must be executed and delivered to City before proceeding with the changed Work or shortly in time thereafter.

10.03 Procedures And Pricing Of Changed Work

- A. Procedures for changed work and pricing of changed work, claims and all forms of extra compensation, are set forth in Section 01 2600 (Modification Procedures).

ARTICLE 11 – TIME ALLOWANCES

11.01 Time Allowances

- A. Time is of the essence. Contract Time may only be changed by Change Order, and all time limits stated in the Contract Documents are to mean that time is of the essence.

11.02 Excusable Delay And Inexcusable Delay Defined.

- A. Excusable Delay. Subject to the provisions on Notice of Delay below, Contract Time may be adjusted in an amount equal to the time lost due to:
1. Changes in the Work ordered by City ("Changes");
 2. Acts or neglect by City, Architect, any City Representative, utility owners or other contractors performing other work, not permitted or provided for in the Contract Documents, provided that Contractor has performed its responsibilities under the Contract Documents (including but not limited to pre-bid investigations) ("Acts or Neglect"); or
 3. Fires, floods, epidemics, abnormal weather conditions beyond the parameters otherwise set forth in this Article, earthquakes, civil or labor disturbances, or acts of God (together, "force majeure events"), provided damages resulting therefrom are not the result of Contractor's failure to protect the Work as required by Contract Documents ("Force Majeure").
- B. Inexcusable Delay. Contract Time shall not be extended for any period of time where Contractor (and/or any Subcontractor) is delayed or prevented from completing any part of the Work due to a

cause that is within Contractor's risk or responsibility under the Contract Documents. Delays attributable to or within the control of a Subcontractor, or its subcontractors, or supplier, are deemed delays within the control of Contractor.

- C. Float. Float shall be treated as a Project resource. Contractor shall not be entitled to a time extension for impacts that consume float, but do not impact the critical path.

11.03 Notice Of Delay

- A. Within seven calendar days of the beginning of any delay (excepting adverse weather delays), Contractor shall notify City in writing, by submitting a notice of delay that shall describe the anticipated delays resulting from the delay event in question. If Contractor requests an extension of time, Contractor shall submit a Time Impact Evaluation (TIE) within ten calendar days of the notice of delay. City will determine all claims and adjustments in the Contract Time. No claim for an adjustment in the Contract Time will be valid and such claim will be waived if not submitted in accordance with the requirements of this subparagraph. In cases of substantial compliance with the seven-day notice requirement here (but not to exceed twenty-one calendar days from the beginning of the delay event), City may in its sole discretion recognize a claim for delay accompanied with the proper TIE, provided Contractor also shows good faith and a manifest lack of prejudice to City from the late notice.

11.04 Compensable Time Extensions

- A. Subject to other applicable provisions of the Contract Documents, Contractor may be entitled to adjustment in Contract Sum in addition to Contract Time for:
1. Excusable delay caused solely by Changes in the Work ordered by City, as provided above, and/or
 2. Excusable delay caused solely by Acts or Neglect by City or other person, as provided above.

11.05 Non-Compensable Time Extensions

- A. Subject to other applicable provisions of the Contract Documents, Contractor may be entitled to adjustment in Contract Time only, without adjustment in Contract Sum, for
1. Periods of excusable delay caused solely by weather or Force Majeure events as provided above in this Article, or
 2. Periods of concurrent delay, where delay results from two or more causes, one of which is compensable (resulting from Changes or Acts or Neglect as set forth above in this Article), and the other of which is non-compensable or unexcusable, such as: acts or neglect of Contractor, Subcontractors or others for whom Contractor is responsible; other acts, omissions and conditions which would not entitle Contractor to adjustment in Contract Time; adverse weather; and/or actions of Force Majeure as provided above in this Article.

11.06 Adverse Weather

- A. Adverse weather delays may be allowed only if the number of workdays of adverse weather exceeds the parameters listed or referenced immediately below in this subparagraph and Contractor proves that adverse weather actually caused delays to work on the critical path. Contractor shall give written notice of intent to claim an adverse weather day within one Day of the adverse weather day occurring.
- B. Claims for extension of time for rain delay will not be granted unless the number of calendar days work is prevented by rain exceeds 110% of the average number of rain days expected for the period of the Contract Time, based on the records of the National Oceanic & Atmospheric Administration (NOAA) weather station closest to the Project Site, as measured and reported by NOAA. (For example, for California, Oregon and Washington, these figures are contained in the ">=0.10 inch" column at the applicable weather station's "General Climate Summary Table" for "Precipitation" at <http://www.wrcc.dri.edu/Climsum.html>), pro-rated in the individual month Contractor starts and finishes Work. Delays due to adverse weather conditions will not be allowed for weather conditions that fall within these parameters.

- C. In order to qualify as an adverse weather delay with respect to the foregoing parameters, (i.) daily rainfall must exceed .1 inch, and/or (ii.) daily snowfall must exceed 1.0 inch or more, at the NOAA station located closest to the Project site, as measured and reported by NOAA. Notwithstanding these allowances, Contractor shall at all times employ all available mitigation measures to enable Work to continue, Contractor shall take reasonable steps to mitigate potential weather delays, such as dewatering the Site, lime treatment, and covering Work and material that could be affected adversely by weather. Failure to do so shall be cause for City to not grant a time extension due to adverse weather, where Contractor could have avoided or mitigated the potential delay by exercising reasonable care.
- D. Contractor shall include the foregoing precipitation parameters as a monthly activity in its progress schedule. As Work on the critical path is affected by precipitation, Contractor shall notify City and request that the days be moved to the affected activities. Any adverse weather days remaining shall be considered Project float available to either City or Contractor.
- E. Adverse weather delay for precipitation shall be recognized for the actual period of time Contractor proves it was delayed by precipitation exceeding the specified parameters. For example, and not by way of limitation, if precipitation exceeding the specified parameters does not in fact delay Contractor's progress on the critical path, then no time extension shall be recognized; and conversely, if Contractor proves to City's satisfaction that precipitation exceeding the specified parameters causes delay to Contractor for a period longer than the number of precipitation days incurred (e.g., if it rains or雪s during grading work), then Contractor shall be entitled to a time extension equal to the actual period of such delay.
- F. During unfavorable weather, wet ground, or other unsuitable construction conditions, Contractor shall employ best practices to protect the Work, manage the construction site and rainwater during inclement weather. Persons performing the Work shall examine surfaces to receive their Work and shall report in writing to Contractor, with copy to City representative and the Architect conditions detrimental to the Work. Failure to examine and report discrepancies makes the Contractor responsible, at no increase in Contract Sum, for corrections City may require. Commencement of Work constitutes acceptance of surface.

11.07 Liquidated Damages

- A. Time is of the essence. Execution of Contract Documents by Contractor shall constitute its acknowledgement that City will actually sustain damages in the form of Contract administration expenses (such as Project management and consultant expenses) in the amount fixed in the Contract Documents for each and every Day during which completion of Work required is delayed beyond expiration of time fixed for completion plus extensions of time allowed pursuant to provisions hereof.
- B. Contractor and City agree that because of the nature of the Project, it would be impractical or extremely difficult to fix the amount of such actual damages incurred by City because of a delay in completion of all or any part of the Work. Contractor and City agree that specified measures of liquidated damages shall be presumed to be the amount of such damages actually sustained by City, and that because of the nature of the Project, it would be impracticable or extremely difficult to fix the actual damages.
- C. Liquidated damages for delay shall cover administrative, overhead, interest on bonds, and general loss of public use damages suffered by City as a result of delay. Liquidated damages shall not cover the cost of completion of the Work, damages resulting from Defective Work, lost revenues or costs of substitute facilities, or damages suffered by others who then seek to recover their damages from City (for example, delay claims of other contractors, subcontractors, tenants, or other third-parties), and defense costs thereof. City may deduct from any money due or to become due to Contractor subsequent to time for completion of entire Work and extensions of time allowed pursuant to provisions hereof, a sum representing then-accrued liquidated damages.

ARTICLE 12 – CLAIMS BY CONTRACTOR

12.01 Obligation to File Claims for Disputed Work

- A. Should it appear to Contractor that the Work to be performed or any of the matters relative to the

Contract Documents are not satisfactorily detailed or explained therein, or should any questions arise as to the meaning or intent of the Contract Documents, or should any dispute arise regarding the true value of any work performed, work omitted, extra work that the Contractor may be required to perform, time extensions, payment to the Contractor during performance of this Contract, performance of the Contract, and/or compliance with Contract procedures, or should Contractor otherwise seek extra time or compensation FOR ANY REASON WHATSOEVER, then Contractor shall first follow procedures set forth in the Contract (including but not limited to other Articles of this Document 00 7200 and Section 01 2600.) If a dispute remains, then Contractor shall give written notice to City that expressly invokes this Article 12. City shall decide the issue in writing within 15 calendar days; and City's written decision shall be final and conclusive. If Contractor disagrees with City's decision, or if Contractor contends that City failed to provide a decision timely, then Contractor's SOLE AND EXCLUSIVE REMEDY is to promptly file a written claim setting forth Contractor's position as required herein.

12.02 Form And Contents Of Claim

- A. Contractor's written claim must identify itself as a "Claim" under this Article 12 and must include the following: (1) a narrative of pertinent events; (2) citation to contract provisions; (3) theory of entitlement; (4) complete pricing of all cost impacts; (5) a time impact analysis of all time delays that shows actual time impact on the critical path; (6) documentation supporting items 1 through 5; a verification under penalty of perjury of the claim's accuracy. The Claim shall be submitted to City within thirty (30) calendar days of receiving City's written decision, or the date Contractor contends such decision was due, and shall be priced like a change order according to Section 01 2600, and must be updated monthly as to cost and entitlement if a continuing claim. Routine contract materials, for example, correspondence, RFI, Change Order requests, or payment requests shall not constitute a claim. Contractor shall bear all costs incurred in the preparation and submission of a claim.

12.03 Administration During/After Claim Submission

- A. City may render a final determination based on the Claim or may in its discretion conduct an administrative hearing on Contractor's claim, in which case Contractor shall appear, participate, answer questions and inquiries, and present any further evidence or analysis requested by City prior to rendering a final determination. Should City take no action on the Claim within 45 calendar days of submission, it shall be deemed denied.
- B. Notwithstanding and pending the resolution of any claim or dispute, Contractor shall diligently prosecute the disputed work to final completion in accordance with City's determination.
- C. After their submission, claims less than \$375,000 shall also be subject to the Local Agency Disputes Act.

12.04 Compliance

- A. The provisions of this Article 12 constitute a non-judicial claim settlement procedure that, pursuant to Section 930.2 of the California Government Code, shall constitute a condition precedent to submission of a valid Government Code Claim under the California Government Code. 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 and the previous dispositions under Paragraph 12.3 above of the claims asserted. Pursuant to Government Code Section 930.2, the one-year period in Government Code section 911.2 shall be reduced to 150 calendar days from either accrual of the cause of action, substantial completion or termination of the contract, whichever occurs first; in all other respects, the Government Code shall apply unchanged.
- B. Failure to submit and administer claims as required in Article 12 shall waive Contractor's right to claim on any specific issues not included in a timely submitted claim. Claim(s) or issue(s) not raised in a timely protest and timely claim submitted under this Article 12 may not be asserted in any subsequent litigation, Government Code Claim, or legal action.
- C. City shall not be deemed to waive any provision under this Article 12, if at City's sole discretion, a

claim is administered in a manner not in accord with this Article 12. Waivers or modifications of this Article 12 may only be made a signed change order approved as to form by legal counsel for both City and Contractor; oral or implied modifications shall be ineffective.

ARTICLE 13 – UNDERGROUND CONDITIONS

13.01 Contractor To Locate Underground Facilities.

- A. During construction, Contractor shall comply with Government Code Sections 4216 to 4216.9, and in particular Section 4216.2 which provides, in part: "Except in an emergency, every person planning to conduct any excavation shall contact the appropriate regional notification center at least two working days, but no more than 14 calendar days, prior to commencing that excavation, if the excavation will be conducted in an area which is known, or reasonably should be known, to contain subsurface installations other than the underground facilities owned or operated by the excavator, and, if practical, the excavator shall delineate with white paint or other suitable markings the area to be excavated. The regional notification center shall provide an inquiry identification number to the person who contacts the center and shall notify any member, if known, who has a subsurface installation in the area of the proposed excavation."
- B. Contractor shall contact USA, and schedule the Work to allow ample time for the center to notify its members and, if necessary, for any member to field locate and mark its facilities. Contractor is charged with knowledge of all subsurface conditions reflected in USA records. Prior to commencing excavation or trenching work, Contractor shall provide City with copies of all USA records secured by Contractor. Contractor shall advise City of any conflict between information provided in Document 00 3132 (Geotechnical Data and Existing Conditions), the Drawings and that provided by USA records. Contractor's excavation shall be subject to and comply with the Contract Documents.
- C. Contractor shall also investigate the existence of existing service laterals, appurtenances or other types of utilities, indicated by the presence of an underground transmission main or other visible facilities, such as buildings, new asphalt, meters and junction boxes, on or adjacent to the Site, even if not shown or indicated in Document 00 3132 (Geotechnical Data and Existing Conditions), the Drawings or that provided by USA records. Contractor shall immediately secure all such available information and notify City and the utility owner, in writing, of its discovery.

13.02 Contractor To Protect Underground Facilities.

- A. At all times during construction, all operating Underground Facilities shall remain in operation, unless the Contract Documents expressly indicate otherwise. Contractor shall maintain such Underground Facilities in service where appropriate; shall repair any damage to them caused by the Work; and shall incorporate them into the Work, including reasonable adjustments to the design location (including minor relocations) of the existing or new installations. Contractor shall take immediate action to restore any in service installations damaged by Contractor's operations.
- B. Prior to performing Work at the Site, Contractor shall lay out the locations of Underground Facilities that are to remain in service and other significant known underground installations indicated by the Underground Facilities Data. Contractor shall further locate, by carefully excavating with small equipment, potholing and principally by hand, all such utilities or installations that are to remain and that are subject to damage. If additional utilities whose locations are unknown are discovered, Contractor shall immediately report to City for disposition of the same. Additional compensation or extension of time on account of utilities not shown or otherwise brought to Contractor's attention, including reasonable action taken to protect or repair damage, shall be determined as provided in this Document 00 7200.
- C. If during construction, an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated in the materials supplied by City for bidding or in information on file at USA or otherwise reasonably available to Contractor, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby (and in no event later than seven calendar days), and prior to performing any Work in connection therewith (except in an emergency), identify the owner of such Underground Facility and give written notice to that owner and to City. During such time, Contractor shall be responsible for the

- safety and protection of such Underground Facility.
- D. The cost of all of the following will be included in the Contract Sum and Contractor shall have full responsibility for (a) reviewing and checking all available information and data including, but not limited to, information made available for bidding and information on file at USA; (b) locating all Underground Facilities shown or indicated in the Contract Documents, available information, or indicated by visual observation including, but not limited to, and by way of example only, engaging qualified locating services and all necessary backhoeing and potholing; (c) coordination of the Work with the owners of such Underground Facilities during construction; and (d) the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.
- E. Consistent with California Government Code §4215, as between City and Contractor, City will be responsible for the timely removal, relocation, or protection of existing main or trunk line utility facilities located on the Site only if such utilities are not identified in the Contract Documents or information made available for bidding. City will compensate for the cost of locating and repairing damage not due to Contractor's failure to exercise reasonable care, removing and relocating such main or trunk line utility facilities not indicated in the Contract Documents or information made available for bidding with reasonable accuracy, and equipment on the Project necessarily idled during such Work. Contractor shall not be assessed liquidated damages for delay in completion of the Project, when such delay was caused by the failure of City or the utility to provide for removal or relocation of such utility facilities.

13.03 Concealed Or Unknown Conditions

- A. If either of the following conditions is encountered at Site when digging trenches or other excavations that extend deeper than four feet below the surface, Contractor shall give a written Notice of Differing Site Conditions to City promptly before conditions are disturbed, except in an emergency as set forth in this Document 00 7200, and in no event later than seven calendar days after first observance of:
1. Subsurface or Latent physical conditions which differ materially from those indicated in the Contract Documents; or
 2. Unknown physical conditions of an unusual nature or which differ materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents.
- B. In response to Contractor's Notice of Differing Site Conditions under this Paragraph, City will investigate the identified conditions, and if they differ materially and cause increase or decrease in Contractor's cost of, or time required for, performance of any part of the Work, City will negotiate the appropriate change order following the procedures set forth in the Contract Documents. If City determines that physical conditions at the Site are not Latent or are not materially different from those indicated in Contract Documents or that no change in terms of the Contract Documents is justified, City will so notify Contractor in writing, stating reasons (with Contractor retaining its rights under Article 12 of this Document 00 7200.)
- C. Contractor shall not be entitled to any adjustment in the Contract Sum or Contract Time regarding claimed Latent or materially different Site conditions (whether above or below grade) if Contractor knew or should have known of the existence of such conditions at the time Contractor submitted its Bid, failed to give proper notice, or relied upon information, conclusions, opinions or deductions of the kind that the Contract Documents preclude reliance upon.
- D. Regarding Underground Facilities, Contractor shall be allowed an increase in the Contract Sum or an extension of the Contract Time, or both, to the extent that they are attributable to the existence of any Underground Facility that is owned and was built by City only where the Underground Facility:
1. Was not shown or indicated in the Contract Documents or in the information supplied for bidding purposes or in information on file at USA; and
 2. Contractor did not know of it; and
 3. Contractor could not reasonably have been expected to be aware of it or to have anticipated it from the information available. (For example, if surface conditions such as

pavement repairs, valve covers, or other markings, indicate the presence of an Underground Facility, then an increase in the Contract Sum or an extension of the Contract Time will not be due, even if the Underground Facility was not indicated in the Contract Documents, in the information supplied to Contractor for bidding purposes, in information on file at USA, or otherwise reasonably available to Contractor.)

- E. Contractor shall bear the risk that Underground Facilities not owned or built by City may differ in nature or locations shown in information made available by City for bidding purposes, in information on file at USA, or otherwise reasonably available to Contractor. Underground Facilities are inherent in construction involving digging of trenches or other excavations on City's Project, and Contractor is to apply its skill and industry to verify the information available.
- F. Contractor's compensation for claimed Latent or materially different Site conditions shall be limited to the actual, reasonable, incremental increase in cost of that portion of the Work, resulting from the claimed Latent or materially different Site conditions. Such calculation shall take into account the estimated value of that portion of the Work and the actual value of that portion of the Work, using for guidance Contractor's or its subcontractor's bid amount and actual amounts incurred for that portion of the Work and the reasonable expectation (if any) of differing or difficult site conditions in the Work area based on the available records and locale of the Work. For example, if Contractor excavates in an area unexpected, then such costs would be recoverable entirely; while if Contractor extends an existing excavation, then such costs would be recoverable if the resulting excavation costs in that work area exceeded the reasonable expectations therefore.

13.04 Notice Of Hazardous Waste Or Materials Conditions

- A. Contractor shall give a written Notice of Hazardous Materials Condition to City promptly, before any of the following conditions are disturbed (except in an emergency as set forth in this Document 00 7200), and in no event later than 24 hours after first observance of any:
 1. Material that Contractor believes may be hazardous waste or hazardous material, as defined in Section 25117 of the Health and Safety Code (including, without limitation, Asbestos, lead, PCBs, petroleum and related hydrocarbons, and radioactive material) that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law ("hazardous material"); or
 2. Other material that may present an imminent substantial danger to persons or property exposed thereto in connection with Work at the Site ("other materials").
- B. Except as otherwise provided in the Contract Documents or as provided by applicable law, Contractor shall not be required to give any notice for the disturbance or observation of any such hazardous materials or other materials where such matter is disturbed or observed as part of the scope of Work under the Contract Documents (such as hazardous waste or hazardous material investigation, remediation or disposal activities which are identified as the subject of Work under the Contract Documents), where Contractor complies with all requirements in the Contract Documents and applicable law respecting such materials.
- C. Contractor's Notice of Hazardous Materials Condition shall indicate whether the hazardous materials or other materials were shown or indicated in the Contract Documents to be within the scope of Work, and whether the hazardous materials or other materials were brought to the Site by Contractor, its Subcontractors, suppliers, or anyone else for whom Contractor is responsible.
- D. Contractor shall not be entitled to any adjustment in the Contract Sum or Contract Time regarding claimed hazardous waste or materials if:
 1. Contractor knew of the existence of such hazardous materials or other materials at the time Contractor submitted its Bid; or
 2. Contractor should have known of the existence of such hazardous material or other materials as a result of its having the responsibility to obtain additional or supplementary examinations, investigation, explorations, tests, studies, and data concerning the conditions at or contiguous to the Site prior to submitting its Bid; or
- 1. Contractor failed to give the written notice within the required timeframe set forth below.
- E. If City determines that conditions involve hazardous materials or other materials and that a

change in Contract Document terms is justified, City will issue either a Request for Proposal or Construction Change Directive under the procedures described in the Contract Documents. If City determines that conditions do not involve hazardous materials or other materials or that no change in Contract Document terms is justified, City will notify Contractor in writing, stating the reasons for its determination.

- F. In addition to the parties' other rights under this Document 00 7200, if Contractor does not agree to resume Work based on a reasonable belief that it is unsafe, or does not agree to resume Work under special conditions, City may order the disputed portion of Work deleted from the Work, or performed by others, or City may invoke its right to terminate Contractor's right to proceed under the Contract Documents in whole or in part, for convenience or for cause as the facts may warrant.
- G. If Contractor does not agree with any City determination of any adjustment in the Contract Sum or Contract Time under this Article, Contractor may make a claim as provided in Article 12 of this Document 00 7200.

ARTICLE 14 – LEGAL AND MISCELLANEOUS

14.01 Laws And Regulations

- A. Contractor shall keep fully informed of and shall comply with all laws, ordinances, regulations and orders of any properly constituted authority affecting the Contract Documents, Work and persons connected with Work, and shall protect and indemnify City and its officers, employees, consultants and agents against any claim or liability, including attorney's fees, arising from or based on violation of law, ordinance, regulation or order, whether by Contractor or by Subcontractors, employees or agents. Authorized persons may at any time enter upon any part of Work to ascertain compliance of all applicable laws, ordinances, regulations and orders.

14.02 Permits And Taxes

- A. Contractor shall procure all permits and licenses applicable to the Work (including environmental matters to the extent applicable); pay all charges and fees, including fees for street opening permits; comply with, implement and acknowledge effectiveness of all permits; initiate and cooperate in securing all required notifications or approvals therefore; and give all notices necessary and incident to due and lawful prosecution of Work, unless otherwise provided herein. City will pay applicable building permits, sanitation and water fees for the completed construction, except as otherwise provided in the Contract Documents. Contractor shall pay all sales and/or use taxes levied on materials, supplies, or equipment purchased and used on or incorporated into Work, and all other taxes properly assessed against equipment or other property used in connection with Work, without any increase in the Contract Sum. Contractor shall make necessary arrangements with proper authorities having jurisdiction over roads, streets, pipelines, navigable waterways, railroads, and other works in advance of operations, even where City may have already obtained permits for the Work.

14.03 Communications And Information Distribution

- A. All communications recognized under the Contract Documents shall be in writing, in the form of a serialized document, by type of communication. For example, RFI's shall be serialized beginning with RFI No. 1; payment applications shall be serialized beginning with Payment Application No. 1, submittals shall be serialized per specification section and transmitted with transmittal sheets beginning with Transmittal No. 1; and correspondence shall be serialized beginning with letter No. 1. Contractor may propose other record management and identification systems or protocols, intended to facilitate orderly transmittal of project information, storage and retrieval of such information, which City will review consistent with these stated objectives, and accept or reject in its sole discretion.
- B. Documents Requiring Signatures. All documents requiring signatures for approval prior to implementing action, as stipulated in other portions of Contract Documents, shall require a manually signed, serialized letter delivered to the other party at its address for notice otherwise specified in the Contract Documents, either personally or by mail.

- C. Electronic data transfer of such correspondence will serve to expedite preliminary concurrence of information, only. Receipt of "hard copy" signature on forms is required prior to implementing action or work as the conditions may require. For example, change orders and authorizations for extra cost, require signatures. A party may acknowledge receipt of PDF copies of required correspondence by e-mail, but in the absence of such acknowledgment, mail or personal delivery is required.
- D. All emails shall be copied to City's and Contractor's Project Representative. City reserves the right to preclude e-mail communication, in whole or in part, as Project needs may require. Communication between City and Contractor shall not be via Twitter, Facebook, or other types of instant text message systems. Any such communications shall be inadmissible for any purpose related to this Contract.

14.04 Suspension Of Work

- A. City may, without cause, order Contractor in writing to suspend, delay or interrupt Work in whole or in part for such period of time as City may determine. An adjustment shall be made for increases in cost of performance of Work of the Contract Documents caused by any such suspension, delay or interruption, calculated using the measures set forth in Section 01 2600 (Modification Procedures). No adjustment shall be made to extent that performance is, was or would have been so suspended, delayed or interrupted by another cause for which Contractor is responsible.

14.05 Termination Of Contract For Cause

- A. The Contractor shall be in default of the Contract Documents and City may terminate the Contractor's right to proceed under the Contract Documents, for cause, in whole or in part, should the Contractor commit a material breach of the Contract Documents and not cure such breach within ten (10) calendar days of the date of notice from City to the Contractor demanding such cure; or, if such breach is curable but not curable within such ten (10) day period, within such period of time as is reasonably necessary to accomplish such cure. (In order for the Contractor to avail itself of a time period in excess of 10 calendar days, the Contractor must provide City within the ten (10) day period with a written plan acceptable to City that demonstrates actual resources, personnel and a schedule to promptly to cure said breach, and then diligently commence and continue such cure according to the written plan).
- B. In the event of termination by City for cause as provided herein, the Contractor shall deliver to City possession of the Work in its then condition, including but not limited to, all designs, engineering, Project records, cost data of all types, plans and specifications and contracts with vendors and subcontractors, all other documentation associated with the Project, and all construction supplies and aids dedicated solely to performing the Work which, in the normal course of construction, would be consumed or only have salvage value at the end of the construction period. The Contractor shall remain fully liable for the failure of any Work completed and materials and equipment provided through the date of such termination to comply with the provisions of the Contract Documents. The provisions of this Section shall not be interpreted to diminish any right which City may have to claim and recover damages for any breach of the Contract Documents or otherwise, but rather, the Contractor shall compensate City for all loss, cost, damage, expense, and/or liability suffered by City as a result of such termination and/or failure to comply with the Contract Documents.
- C. In the event a termination for cause is later determined to have been made wrongfully or without cause, then the termination shall be treated as a termination for convenience, and the Contractor shall have no greater rights than it would have had following a termination for convenience. Any Contractor claim arising out of a termination for cause shall be made in accord with Article 12 herein. No other loss, cost, damage, expense or liability may be claimed, requested or recovered by the Contractor.

14.06 Termination Of Contract For Convenience

- A. City may terminate performance of the Work under the Contract Documents in accordance with this clause in whole, or from time to time in part, whenever City shall determine that termination is

in City's best interest. Termination shall be effected by City delivering to the Contractor notice of termination specifying the extent to which performance of the Work under the Contract Documents is terminated, and the effective date of the termination.

- B. Contractor shall comply strictly with City's direction regarding the effective date of the termination, the extent of the termination, and shall stop work on the date and to the extent specified.
- C. Contractor shall be entitled to a total payment on account of the Contract work so terminated measured by (i.) the actual cost to Contractor of Work actually performed, up to the date of the termination, with profit and overhead limited to twelve percent (12%) of actual cost of work performed, up to but not exceeding the actual contract value of the work completed as measured by the Schedule of Values and Progress Schedule, (ii.) offset by payments made and other contract credits. In connection with any such calculation, however, City shall retain all rights under the Contract Documents, including but not limited to claims, indemnities, or setoffs.
- D. Under no circumstances may Contractor recover legal costs of any nature, nor may Contract recover costs incurred after the date of the termination.

14.07 Contingent Assignment Of Subcontracts

- A. Contractor hereby assigns to City each Subcontract for a portion of the Work, provided that:
 - 1. The assignment is effective only after City's termination of Contractor's right to proceed under the Contract Documents (or portion thereof relating to that Subcontract) as set forth herein.
 - 2. The assignment is effective only for the Subcontracts which City expressly accepts by notifying the Subcontractor in writing;
 - 3. The assignment is subject to the prior rights, if any, of the Surety, obligated by Document 00 6113.13 (Construction Performance Bond) provided under the Contract Documents, where the Surety exercises its rights to complete the Contract;
 - 4. After the effectiveness of an assignment, Contractor shall, at its sole cost and expense (except as otherwise provided in this Document 00 7200), sign all instruments and take all actions reasonably requested by City to evidence and confirm the effectiveness of the assignment in City; and
 - 5. Nothing in this Paragraph shall modify or limit any of Contractor's obligations to City arising from acts or omissions occurring before the effectiveness of any Subcontract assignment, including but not limited to all defense, indemnity and hold-harmless obligations arising from or related to the assigned Subcontract.

14.08 Remedies And Contract Integration

- A. Subject to Contract Documents provisions regarding Contractor claims, claim review, and claim resolution, and subject to the limitations therein, the exclusive jurisdiction and venue for resolving all claims, counter claims, disputes and other matters in question between City and Contractor arising out of or relating to Contract Documents, any breach thereof or the Project shall be the applicable court of competent jurisdiction located in the State and County where the Project is located. All City remedies provided in the Contract Documents shall be taken and construed as cumulative and not exclusive; that is, in addition to each and every other remedy herein provided; and in all instances City shall have any and all other equitable and legal rights and remedies which it would have according to law.
- B. The Contract Documents, any Contract Modifications and Change Orders, shall represent the entire and integrated agreement between City and Contractor regarding the subject matters hereof and thereof and shall constitute the exclusive statement of the terms of the parties' agreement. The Contract Documents, and any Contract Modifications and Change Orders, shall supersede any and all prior negotiations, representations or agreements, written or oral, express or implied, that relate in any way to the subject matter of the Contract Documents or written Modifications. City and Contractor represent and agree that, except as otherwise expressly provided in the Contract Documents, they are entering into the Contract Documents and any subsequent written Modification in sole reliance upon the information set forth or referenced in the Contract Documents or Contract Modifications; the parties are not and will not rely on any other

- information, which shall be inadmissible in any proceeding to enforce these documents.
- C. Either party's waiver of any breach or failure to enforce any of the terms, covenants, conditions or other provisions of the Contract Documents at any time shall not in any way affect, limit, modify or waive that party's right thereafter to enforce or compel strict compliance with every term, covenant, condition or other provision hereof, any course of dealing or custom of the trade or oral representations notwithstanding.
 - D. Neither acceptance of the whole or any part of Work by City nor any verbal statements on behalf of City or its authorized agents or representatives shall operate as a waiver or modification of any provision of the Contract Documents, or of any power reserved to City herein nor any right to damages provided in the Contract Documents.

14.09 Interpretation.

- A. Should any part, term or provision of this Agreement or any of the Contract Documents, or any document required herein or therein to be executed or delivered, be declared invalid, void or unenforceable, all remaining parts, terms and provisions shall remain in full force and effect and shall in no way be invalidated, impaired or affected thereby. If the provisions of any law causing such invalidity, illegality or unenforceability may be waived, they are hereby waived to the end that this Agreement and the Contract Documents may be deemed valid and binding agreements, enforceable in accordance with their terms to the greatest extent permitted by applicable law. In the event any provision not otherwise included in the Contract Documents is required to be included by any applicable law, that provision is deemed included herein by this reference (or, if such provision is required to be included in any particular portion of the Contract Documents, that provision is deemed included in that portion).
- B. Contract Documents shall not be construed to create a contractual relationship of any kind between (1) Project Manager or any City's representative and Contractor; (2) City and/or its Representatives and a Subcontractor, sub-Subcontractor, or supplier of any Project labor, materials, or equipment; or (3) between any persons or entities other than City and Contractor.

14.10 Patents

- A. Fees or claims for any patented invention, article or arrangement that may be used upon or in any manner connected with performance of the Work or any part thereof shall be included in the Bid price for doing the Work. Contractor shall defend, indemnify and hold harmless City and each of its officers, employees, consultants and agents, including, but not limited to, the Board and each City's Representative, from all damages, claims for damages, costs or expenses in law or equity, including attorney's fees, arising from or relating to any claim that any article supplied or to be supplied under the Contract Documents infringes on the patent rights, copyright, trade name, trademark, service mark, trade secret or other intellectual property right of any person or persons or that the person or entity supplying the article does not have a lawful right to sell the same. Such costs or expenses for which Contractor agrees to indemnify and hold harmless the above indemnities include but are not limited to any and all license fees, whether such fees are agreed by any indemnitee or ordered by a court or administrative body of any competent jurisdiction.

14.11 Substitution For Patented And Specified Articles

- A. Except as noted specifically in the instructions to Bidders or in Contract Documents, whenever in Specifications, material or process is designated by patent or proprietary name or by name of manufacturer, such designation shall be deemed to be used for purpose of facilitating description of material and process desired, and shall be deemed to be followed by the words "or Approved Equal" and Contractor may offer any substitute material or process that Contractor considers "equal" in every respect to that so designated and if material or process offered by Contractor is, in opinion of City, Equal in every respect to that so designated, its use will be approved. However, Contractor may utilize this right only by timely submitting Document 00 6325 (Substitution Request Form) as provided in Document 00 2113 (Instructions to Bidders). A substitution will be approved only if it is a true "or equal" item in every aspect of its design and quality, including but not limited to its dimensions, weights, service requirements, durability, functioning, impact on contiguous construction elements, overall schedule and design.

14.12 Interest Of Public Officers

- A. No representative, officer, or employee of City no member of the governing body of the locality in which the Project is situated, no member of the locality in which City was activated, and no other public official of such locality or localities who exercises any functions or responsibilities with respect to the Project, during the tenure of the official or for one year thereafter, shall, as principal, agent, attorney or otherwise, be directly or indirectly interested, in the Contract Documents or the proceeds thereof.

14.13 Limit Of Liability

- A. CITY, AND EACH OF ITS OFFICERS, BOARD MEMBERS, EMPLOYEES, CONSULTANTS AND AGENTS INCLUDING, BUT NOT LIMITED TO, PROJECT MANAGER AND EACH OTHER CITY REPRESENTATIVE, SHALL HAVE NO LIABILITY TO CONTRACTOR FOR SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES, EXCEPT TO THE LIMITED EXTENT THAT THESE CONTRACT DOCUMENTS OR APPLICABLE PUBLIC CONTRACTING STATUTES MAY SPECIFY THEIR RECOVERY.

ARTICLE 15 – WORKING CONDITIONS AND PREVAILING WAGES**15.01 Use Of Site/Sanitary Rules**

- A. All portions of the Work shall be maintained at all times in neat, clean and sanitary condition. Contractor shall furnish toilets for use of Contractor's and Subcontractors' employees on the Site where needed, and their use shall be strictly enforced. All toilets shall be properly secluded from public observation, and shall be located, constructed and maintained subject to City's approval.
- B. Contractor shall confine construction equipment, the storage of materials and equipment and the operations of workers to the Site and land areas identified in and permitted by Contract Documents and other land and areas permitted by applicable laws and regulations, rights of way, permits and easements or as designated by City, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, any improvement located thereon, or to City or occupant thereof resulting from the performance of Work.
- C. During the progress of the Work, Contractor shall keep the Site and the Project free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work, Contractor shall clean the site, remove all waste materials, rubbish and debris from and about the Site as well as all tools, appliances, construction equipment and machinery and surplus materials. Contractor shall leave the premises clean and ready for occupancy by City at Substantial Completion of Work. Contractor shall restore to original condition all property not designated for alteration by Contract Documents.
- D. Contractor shall not load nor permit any part of any structure or pavement to be loaded in any manner that will endanger the structure or pavement, nor shall Contractor subject any part of Work or adjacent property to stresses or pressures that will endanger it. Contractor shall conduct all necessary existing conditions investigation regarding structural, mechanical, electrical or any other system existing, shall perform Work consistent with such existing conditions, and shall have full responsibility for insufficiencies or damage resulting from insufficiencies of existing systems, equipment or structures to accommodate performing the Work.

15.02 Protection Of Work, Persons, And Property

- A. Contractor shall be responsible for initiating, maintaining and supervising all safety and site security precautions and programs in connection with Work, and shall develop and implement a site security and safety plan throughout construction. Contractor shall comply with all safety requirements specified in any safety program established by City, or required by state, federal or local laws and ordinances. Contractor shall be responsible for all theft or damage to Work, property or structures, and all injuries to persons, either on the Site or constituting the Work (e.g., materials in transit), arising from the performance of Work of the Contract Documents from a cause.

- B. Contractor shall comply with all applicable laws and regulations of any public body having jurisdiction for safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation and replacement of their property.
- C. Contractor shall remedy all damage, injury or loss to any property referred to above in this Article, caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, supplier, or any other person or organization directly or indirectly employed by any of them to perform or furnish any Work or anyone for whose acts any of them may be liable. Contractor's duties and responsibility for safety and for protection of Work shall continue until such time as all the Work is completed and Final Acceptance of the Work. City and its agents do not assume any responsibility for collecting any indemnity from any person or persons causing damage to Contractor's Work.
- D. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.
- E. City may, at its option, retain such moneys due under the Contract Documents as City deems necessary until any and all suits or claims against Contractor for injury to persons or property shall be settled and City receives satisfactory evidence to that effect.
- F. Work within the right-of-way lines of the city and/or City and/or State shall be done in accordance with the standards and specifications of the controlling agency. Permit for such work shall be obtained and paid for by the Contractor before executing the work within such right-of-ways.

15.03 Responsibility For Safety And Health

- A. Contractor shall ensure that its and each tier of Subcontractors' employees, agents and invitees comply with applicable health and safety laws while at the Site. These laws include the Occupational Safety and Health Act of 1970 and rules and regulations issued pursuant thereto, and City's safety regulations as amended from time to time. Contractor shall comply with all City directions regarding protective clothing and gear.
- B. Contractor shall be fully responsible for the safety of its and its Subcontractors' employees, agents and invitees on the Site. Contractor shall notify City, in writing, of the existence of hazardous conditions, property or equipment at the Site that are not under Contractor's control. Contractor shall be responsible for taking all the necessary precautions against injury to persons or damage to the property of Contractor, Subcontractors or persons from recognized hazards until the responsible party corrects the hazard.
- C. Contractor shall confine all persons acting on its or its Subcontractors' behalf to that portion of the Site where Work under the Contract Documents is to be performed, City-designated routes for ingress and egress thereto, and any other City-designated area. Except those routes for ingress and egress over which Contractor has no right of control, within such areas, Contractor shall provide safe means of access to all places at which persons may at any time have occasion to be present.

15.04 Emergencies

- A. In emergencies affecting the safety or protection of persons or Work or property at the Site or adjacent thereto, Contractor, without special instruction or authorization from City, is obligated to act to prevent threat and damage, injury or loss, until directed otherwise by City. Contractor shall give City prompt written notice if Contractor believes that any significant changes in Work or variations from Contract Documents have been caused thereby. If City determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Change Order or Construction Change Directive will be issued to document the consequences of such action.

15.05 Use Of Roadways And Walkways

- A. Contractor shall not unnecessarily interfere with use of any roadway, walkway or other facility for

vehicular or pedestrian traffic. Before beginning any interference and only with City's prior concurrence, Contractor may provide detour or temporary bridge for traffic to pass around or over the interference, which Contractor shall maintain in satisfactory condition as long as interference continues. Unless otherwise provided in the Contract Documents, Contractor shall bear the cost of these temporary facilities.

15.06 Nondiscrimination

- A. No person or entity shall discriminate in the employment of persons upon public works because of race, religious creed, color, national origin, ancestry, physical disability, mental disability, medical condition, marital status, sexual preference, or gender of such persons, except as provided in Section 12940 of the California Government Code. Every contractor for public works violating the provisions of Section 1735 of the California Labor Code is subject to all the penalties imposed for a violation of Chapter 1, Part 7, Division 2 of the California Labor Code.

15.07 Prevailing Wages And Working Hours

- A. Contractor shall pay to persons performing labor in and about Work provided for in the Contract Documents an amount equal to or more than the general prevailing rate of per diem wages for (1) work of a similar character in the locality in which the Work is performed and (2) legal holiday and overtime work in said locality. The per diem wages shall be an amount equal to or more than the stipulated rates contained in a schedule that has been ascertained and determined by the Director of the State Department of Industrial Relations and City to be the general prevailing rate of per diem wages for each craft or type of workman or mechanic needed to execute this Contract. Contractor shall also cause a copy of this determination of the prevailing rate of per diem wages to be posted at each Site.
- B. Contractor shall forfeit, as a penalty to City, Fifty Dollars (\$50.00) for each laborer, workman, or mechanic employed in performing labor in and about the Work provided for in the Contract Documents for each Day, or portion thereof, that such laborer, workman or mechanic is paid less than the said stipulated rates for any Work done under the Contract Documents by him or her or by any Subcontractor under him or her, in violation of Articles 1 and 2 of Chapter 1 of Part 7 of Division II of the California Labor Code. The sums and amounts which shall be forfeited pursuant to this Paragraph and the terms of the California Labor Code shall be withheld and retained from payments due to Contractor under the Contract Documents, pursuant to this Document 00 7200 and the California Labor Code, but no sum shall be so withheld, retained or forfeited except from the final payment without a full investigation by either the State Department of Industrial Relations or by City. The Labor Commissioner pursuant to California Labor Code §1775 shall determine the final amount of forfeiture.
- C. Contractor shall insert in every subcontract or other arrangement which Contractor may make for performance of Work or labor on Work provided for in the Contract, provision that Subcontractor shall pay persons performing labor or rendering service under subcontract or other arrangement not less than the general prevailing rate of per diem wages for work of a similar character in the locality in which the Work is performed, and not less than the general prevailing rate of per diem wages for holiday and overtime work fixed in the California Labor Code.
- D. Contractor stipulates that it shall comply with all applicable wage and hour laws, including without limitation, California Labor Code §§ 1776 and 1810-1815. Failure to so comply shall constitute a default under this Contract.
- E. Contractor and its Subcontractors shall be responsible for compliance with Labor Code §§ 1810-1815.
 1. Eight hours of labor performed in execution of the Contract constitutes a legal day's work. The time of service of any workman employed on the Project is limited and restricted to 8 hours during any one calendar day, and 40 hours during any one calendar week.
 2. Contractor and its Subcontractors shall keep an accurate record showing the name of and actual hours worked each calendar day and each calendar week by each worker employed by him or her in connection with the Project. The record shall be kept open at all reasonable hours to the inspection City and to the Division of Labor Standards Enforcement.

3. Contractor or its Subcontractors shall, as a penalty to City, forfeit twenty-five dollars (\$25) for each worker employed in the execution of the Contract Documents by the respective Contractor or Subcontractor for each calendar day during which the worker is required or permitted to work more than 8 hours in any one calendar day and 40 hours in any one calendar week in violation of the provisions of Labor Code §§ 1810-1815.
 4. Work performed on the Project by employees of Contractor or its Subcontractors in excess of 8 hours per day, and 40 hours during any one week, shall be permitted upon compensation for all hours worked in excess of 8 hours per day at not less than 1 1/2 times the basic rate of pay.
- F. Contractor and its Subcontractors shall be responsible for compliance with Labor Code Section 1776.
1. Contractor and Subcontractors must keep accurate payroll records, 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 him or her in connection with the Work of the Contract Documents. Each payroll record shall contain or be verified by a written declaration as required by Labor Code Section 1776.
 2. The payroll records enumerated above must be certified and shall be available for inspection at all reasonable hours at the principal office of the Contractor as required by Labor Code Section 1776.
 - a. Contractor shall inform City of the location of records enumerated above, including the street address, city and county, and shall, within five working days, provide a notice of a change of location and address.
 - b. Contractor or Subcontractor has 10 calendar days in which to comply subsequent to receipt of a written notice requesting the records enumerated above. In the event that the Contractor or Subcontractor fails to comply with the ten-day period, he or she shall, as a penalty to City on whose behalf the contract is made or awarded, forfeit \$25.00 for each calendar day, or portion thereof, for each worker, until strict compliance is effectuated. Upon the request of the Division of Apprenticeship Standards or the Division of Labor Standards Enforcement, these penalties shall be withheld from progress payments then due. Contractor is not subject to a penalty assessment pursuant to this Paragraph due to the failure of a Subcontractor to comply with this Paragraph.
 3. Contractor shall also deliver certified payrolls to City with each Application for Payment as set forth above in this Document 00 7200 (General Conditions).

15.08 Environmental Controls

- A. Contractor shall comply with all rules, regulations, ordinances, and statutes that apply to any Work performed under the Contract Documents including, without limitation, any toxic, water, stormwater management and soil pollution controls and air pollution controls specified in California Government Code §11017. Contractor shall be responsible for insuring that Contractor's Employees, Subcontractors, and the public are protected from exposure to airborne hazards or contaminated water, soil, or other toxic materials used during or generated by activities on the Site or associated with the Project.

15.09 Shoring Safety Plan

- A. Any conflict between this Paragraph and Division 2 of the Specifications shall be resolved in favor of the most stringent requirement.
- B. At least five calendar days in advance of any excavation five feet or more in depth, Contractor shall submit to City a detailed plan showing the shoring, bracing and sloping design (including calculations) and other provisions to be made for worker protection from the hazard of caving ground during the excavation, as required by California Labor Code §6705. A civil or structural engineer registered in California shall prepare and sign any plan that varies from the shoring system standards established by the State Construction Safety Orders.

- C. During the course of Work, Contractor shall be responsible for determining where sloping, shoring, and/or bracing is necessary and the adequacy of the design, installation, and maintenance of all shoring and bracing for all excavation, including any excavation less than five feet in depth. Contractor will be solely responsible for any damage or injuries that may result from excavating or trenching. City's acceptance of any drawings showing the shoring or bracing design or Work schedule shall not relieve Contractor of its responsibilities under this Paragraph.
- D. Appoint a qualified supervisory employee who shall be responsible to determine the sloping or shoring system to be used depending on local soil type, water table, stratification, depth, etc.

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DOCUMENT 00 7201

SUPPLEMENTAL GENERAL CONDITIONS

[OPTIONAL]

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DOCUMENT 00 7316**SUPPLEMENTARY CONDITIONS – INSURANCE AND INDEMNIFICATION****ARTICLE 1 – INSURANCE**

- 1.01 At or before the date specified in Document 00 2113 (Instructions to Bidders), Contractor shall furnish to City of Berkeley (“City”) satisfactory proof that Contractor has taken out for the entire period covered by the Contract the following classes of insurance in the form and with limits and deductibles specified below, unless otherwise specified in Contract Documents:**
- A. Comprehensive General Liability Insurance covering claims for personal injury, bodily injury and property damage arising out of the Work and in a form providing coverage not less than that of a Standard Commercial General Liability Insurance policy (“Occurrence Form”). Such insurance shall provide for all operations and include independent contractors, products liability, completed operations for one year after Final Completion and acceptance of the final payment for the Work, contractual liability, and coverage for explosion, collapse, and underground hazards. The limits of such insurance shall not be coverage of less than **\$2,000,000** each occurrence, **\$2,000,000** general aggregate limit, and **\$2,000,000** aggregate for products and completed operations, with defense costs payable in addition to policy limits. The policies shall be endorsed to provide Broad Form Property Damage Coverage.
 - B. Comprehensive Automobile Liability Insurance covering all owned, non-owned, and hired vehicles. Such insurance shall provide coverage not less than the standard Comprehensive Automobile Liability policy with limits not less than **\$2,000,000** each occurrence Bodily Injury, and **\$2,000,000** each occurrence Property Damage.
 - C. All-Risk Course of Construction Insurance including damage to property owned by City, Contractor or third parties caused by fire. Insurance shall be in the amount of 100 percent of the completed value of the Work to be performed under this Contract. Deductible shall not exceed **\$25,000**. Each loss shall be borne by Contractor.
 - D. Workers’ Compensation Insurance for all persons whom the Contractor may employ in carrying out Work contemplated under Contract Documents, in accordance with the Act of Legislature of State of California, known as “Workers’ Compensation Insurance and Safety Act,” approved May 26, 1913, and all acts amendatory or supplemental thereto, in the statutory amount. Workers’ Compensation Insurance is **\$1,000,000** each accident, with defense cost payable in addition to policy limits.
 - E. Environmental Impairment Liability Insurance covering bodily injury and property damage utilizing an occurrence policy form, in an amount no less than **\$1,000,000** combined single limit for each occurrence, subject to a **\$1,000,000** aggregate applicable to each job, with defense costs payable in addition to policy limits. The minimum deductible or self-insured retention permissible is **\$25,000** each occurrence.
- 1.02** All policies of insurance shall be placed with insurers acceptable to City. The insurance underwriter(s) for all insurance policies except Workers’ Compensation shall have an A. M. Best Company rating of A-, VIII or better, unless otherwise specified in Contract Documents. Required minimum amounts of insurance may be increased should conditions of Work, in opinion of City, warrant such increase. Contractor shall increase required insurance amounts upon direction by City.
- 1.03** Required Endorsements: The policies required under Document 00 7200 (General Conditions) and this Document 00 7316 shall be endorsed as follows:
- A. City of Berkeley, its officers, agents, volunteers, consultants, and employees shall be named as additional insureds, but only with respect to liability arising out of the activities of the named insured, and there shall be a waiver of subrogation as to each named and additional insured.

- B. Each such policy shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limit of the insurance company's liability required hereunder. Should any of the policies identified herein contain a "cross-suits" exclusion, such exclusion must not apply to any additional insureds.
 - C. Written notice of cancellation or of any limits reduction change in said policy shall be mailed to the City thirty (30) calendar days in advance of the effective date thereof, and ten (10) calendar days written notice to the same in advance of payment of any insurance claims under such policies to any person, firm or entity.
 - D. Insurance shall be primary insurance and no other insurance or self-insured retention carried or held by any named or additional insureds shall be called upon to contribute to a loss covered by insurance for the named insured.
- 1.04** Written notice of cancellation, non-renewal, or reduction in coverage of any policy shall be mailed to City (Attention: Project Manager and the Construction Manager) at the address listed in Document 00 5200 (Agreement), 30 calendar days in advance of the effective date of the cancellation, non-renewal, or reduction in coverage. Written notice of cancellation for non-payment shall be mailed within 10 calendar days of cancellation.
- 1.05** Certificates of insurance and endorsements shall have clearly typed thereon City Specification Number, and Title of Project of Contract Documents. Contractor shall maintain insurance in full force and effect during entire period of performance of Contract Documents.
- 1.06** Contractor shall keep insurance in force during warranty and guarantee periods, except that Contractor may discontinue All-Risk Course of Construction Insurance after Final Payment. At time of making application for extension of time, and during all periods exceeding the Contract Time resulting from any cause, Contractor shall submit evidence that insurance policies will be in effect during requested additional period of time. Upon City's request, Contractor shall submit to City, within 30 calendar days, copies of the actual insurance policies or renewals or replacements.
- 1.07** Contractor shall pay all insurance premiums, including any charges for required waivers of subrogation or the endorsement of additional insureds. If Contractor fails to maintain insurance, City may take out comparable insurance, and deduct and retain amount of premium from any sums due Contractor under Contract Documents.
- 1.08** If injury occurs to any employee of Contractor, Subcontractor or sub-subcontractor for which the employee, or the employee's dependents in the event of employee's death, is entitled to compensation from City under provisions of the Workers' Compensation Insurance and Safety Act, as amended, or for which compensation is claimed from City, City may retain out of sums due Contractor under Contract Documents, amount sufficient to cover such compensation, as fixed by the Act, as amended, until such compensation is paid, or until it is determined that no compensation is due. If City is compelled to pay compensation, City may, in its discretion, either deduct and retain from the Contract Sum the amount so paid, or require Contractor to reimburse City.
- 1.09** Nothing herein shall be construed as limiting in any way the extent to which Contractor or any Subcontractor may be held responsible for payment of damages resulting from their operations.
- 1.10** All Subcontractors shall maintain the same insurance required to be maintained by Contractor with respect to their portions of the Work unless otherwise indicated in Contract Documents, and Contractor shall cause the Subcontractors to furnish proof thereof to City within ten calendar days of City's request.
- 1.11** The following provisions apply to any licensed professional engaged by Contractor to perform portions of the Work ("Professional").
- A. Each Professional shall maintain the following insurance, unless otherwise specified in Contract Documents:
 - B. Professional Liability Insurance, insuring against professional errors and omissions arising from

Professional's Work on the Project, in an amount not less than **\$2,000,000** combined single limit for each occurrence. If Professional cannot provide an occurrence policy, Professional shall provide insurance covering claims made as a result of performance of Work on this Project and shall maintain such insurance in effect for not less than two years following Final Completion of the Project.

- C. Professional shall satisfy all other provisions of this Document 00 7316 relating to that insurance, including without limitation providing required insurance certificates (containing the required endorsements) before commencing its Work on the Project.

ARTICLE 2 – RESPONSIBILITY OF CONTRACTOR AND INDEMNIFICATION

- 2.01** City and each of its officers, employees, consultants and agents including, but not limited to, the Board, Project Manager and Construction Manager and each City's Representative, shall not be liable or accountable in any manner for loss or damage that may happen to any part of the Work; loss or damage to materials or other things used or employed in performing the Work; injury, sickness, disease, or death of any person; or damage to property resulting from any cause whatsoever except their sole negligence, willful misconduct or active negligence, attributable to performance or character of the Work, and Contractor releases all of the foregoing persons and entities from any and all such claims.
- 2.02** To the furthest extent permitted by law (including without limitation California Civil Code §2782), Contractor shall assume defense of, and indemnify and hold harmless, City and each of its officers, employees, consultants and agents, including but not limited to the Board, Project Manager and Construction Manager and each City's Representative, from claims, suits, actions, losses and liability of every kind, nature and description, including but not limited to claims and fines of regulatory agencies and attorney's fees and consultant's fees, directly or indirectly arising out of, connected with or resulting from performance of the Work, failure to perform the Work, or condition of the Work which is caused in whole or part by any act or omission of Contractor, Subcontractors, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, resulting from any cause whatsoever except their sole negligence, willful misconduct or active negligence.
- 2.03** With respect to third-party claims against Contractor, Contractor waives any and all rights to any type of express or implied indemnity against City and each of its officers, employees, consultants and agents including, but not limited to City, the Board, Project Manager and Construction Manager and each City's Representative. City shall provide timely notice to Contractor of any third-party claim relating to the Contract Documents, in accordance with Section 9201 of the California Public Contract Code.
- 2.04** Approval or purchase of any insurance contracts or policies shall in no way relieve from liability nor limit the liability of Contractor, its Subcontractors of any tier, or the officers or agents of any of them.
- 2.05** To the furthest extent permitted by law (including, without limitation, Civil Code §2782), the indemnities, releases of liability and limitations of liability, claims procedures, and limitations of remedy expressed throughout Contract Documents shall apply even in the event of breach of Contract, negligence (active or passive), fault or strict liability of the party(ies) indemnified, released, or limited in liability, and shall survive the termination, rescission, breach, abandonment, or completion of the Work or the terms of the Contract Documents. If Contractor fails to perform any of these defense or indemnity obligations, City may in its discretion back charge Contractor for City's costs and damages resulting therefrom and withhold such sums from progress payments or other Contract moneys which may become due.
- 2.06** The indemnities in the Contract Documents shall not apply to any indemnified party to the extent of its sole negligence or willful misconduct; nor shall they apply to City or other indemnified party to the extent of its active negligence.

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DOCUMENT 00 7317

SUPPLEMENTARY CONDITIONS – CITY OF BERKELEY CONTRACTING POLICIES

ARTICLE 1 – GENERAL

1.01 DESCRIPTION

- A. This document includes requirements which supplement the sections of the General Conditions.

1.02 PROHIBITED DISCRIMINATION. The following paragraphs shall be added to the General Conditions as a new Article 16.A, and, with the additions set forth in paragraphs 1.03 through 1.08, below, shall constitute a new Section 16 of Document 00 7200, General Conditions, entitled "16: City of Berkeley Contracting Policies".

"16. A PROHIBITED DISCRIMINATION: During prosecution of the Work to be done under the Contract, Contractor shall comply with the provisions of Berkeley Municipal Code ("B.M.C.") Chapter 13.26, including, but not limited to, the following:

1. Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, ancestry, national origin, age (over 40), sex, pregnancy, marital status, disability, sexual orientation or AIDS.
2. Contractor shall permit the City access to records of employment, employment advertisements, application forms, EEO-1 forms, affirmative action plans and any other documents which, in the opinion of the City, are necessary to monitor compliance with this non-discrimination provision. In addition, Contractor shall submit forms supplied by the City to monitor this non-discrimination provision."

1.03 CONFLICTS OF INTEREST PROHIBITED. The following paragraphs shall be added to Document 00 7200, General Conditions, as a new Section:

"16. B CONFLICTS OF INTEREST PROHIBITED:

1. In accordance with Government Code section 1090, Berkeley City Charter section 36 and B.M.C. Chapter 3.64, neither Contractor nor any employee, officer, director, partner or member of Contractor or immediate family member of any of the preceding, shall have served as an elected officer, an employee, or a City board, committee or commission member, who has directly or indirectly influenced the making of the Agreement.
2. In accordance with Government Code section 1090 and the Political Reform Act, Government Code section 87100 *et seq.*, no person who is a director, officer, partner, trustee, employee or consultant of the Contractor, or immediate family member of any of the preceding, shall make or participate in a decision made by the City or a City board, commission or committee, if it is reasonably foreseeable that the decision will have a material effect on any source of income, investment or interest in real property of that person or Contractor.
 - a. Interpretation of this section shall be governed by the definitions and provisions used in the Political Reform Act, Government Code section 87100 *et seq.*, its implementing regulations, manuals and codes, Government Code section 1090, Berkeley City Charter section 36 and B.M.C. Chapter 3.64."

1.04 NUCLEAR FREE BERKELEY ORDINANCE. The following paragraphs shall be added to Document 00 7200, General Conditions, as a new Section:

"16. C NUCLEAR FREE BERKELEY ORDINANCE:

1. Contractor agrees to comply with B.M.C. Chapter 12.90, the Nuclear Free Berkeley Act, as amended from time to time."

1.05 CONTRACTUAL RELATIONS WITH PROHIBITED ENTITIES. The following paragraphs shall be added to Document 00 7200, General Conditions, as a new Section:

"16. D CONTRACTUAL RELATIONS WITH PROHIBITED ENTITIES

1. OPPRESSIVE STATES

- a. In accordance with Resolution No. 59,853-N.S. (Appendix 00812-A), Contractor certifies that it has no contractual relations with, and agrees during the term of this agreement to forego contractual relations to provide personal services to, the following entities:
 1. The governing regime in any Oppressive State.
 2. Any business or corporation organized under the authority of the governing regime of any Oppressive State.
 3. Any individual, firm, partnership, corporation, association, or any other commercial organization, and including parent-entities and wholly-owned subsidiaries (to the extent that their operations are related to the purpose of its contract with the City), for the express purpose of assisting in business operations or trading with any public or private entity located in any Oppressive State.
- b. Appendix A to Resolution No. 59,853-N.S., and Resolution No. 60,382-N.S. and 70,606-N.S. designates the following as Oppressive States for the purposes of this Contract:
 1. Tibet Autonomous Region and the provinces of Ado, Kham, and U-Tsang; and Burma (Myanmar)
 - c. Contractor's failure to comply with this section shall constitute a default of this Contract and City may terminate the Contractor's right to proceed with the Work pursuant to Document 00 7200, General Conditions, Article 14.05.
 1. In the event that the City terminates Contractor due to a default under this provision, City may deem Contractor a non-responsible bidder for five (5) years from the date this Contract is terminated."

1.06 REQUIRED AND PROHIBITED WORK MATERIALS. The following paragraphs are added to Document 00 7200, General Conditions, as a new Section:

"16. E REQUIRED AND PROHIBITED WORK MATERIALS

1. RECYCLED PAPER

- a. If Contractor is required by this Agreement to prepare a written report or study, Contractor shall use recycled paper for said report or study when such paper is available at a cost of not more than ten percent more than the cost of virgin paper, and when such paper is available at the time it is needed. For the purposes of this Agreement, recycled paper is paper that contains at least 50% recycled product. If recycled paper is not available, Contractor shall use white paper. Written reports or studies prepared under this Agreement shall be printed on both sides of the page whenever practical.

TROPICAL HARDWOODS

- a. Contractor shall comply with the terms of Resolution No. 58,291-N.S. (Appendix 00812-B) prohibiting the use of any tropical hardwood or wood product, including, but not limited to, those enumerated in Resolution No. 58,291-N.S. Contractor must submit, with its bid, a statement Tropical Hardwood Disclosure form.
- b. Except as expressly permitted by the application of Sections 3.B and 4.B. of Resolution No. 58,291-N.S., Contractor shall not provide any items to the City in performance of this contract which are tropical hardwoods or tropical wood products.
- c. Contractor's failure to comply with this section shall constitute a default of this Agreement and Contractor agrees that City may take any of the following actions:
 1. terminate the Contractor's right to proceed with the Work pursuant to Document 00 7200, General Conditions, Article 14.05;
 2. withhold funds due the Contractor under any contract with the City;
 3. order revision of the Contract Documents based upon a material breach of Contract Documents provisions or pertaining to representations made in bidding, execution or performance of the Contract Documents;
 4. disqualify the Contractor from eligibility for providing commodities or services to the City for a period not to exceed five (5) years, with a right to review and reconsideration by the City after two (2) years upon a showing of corrective action, indicating violations are not likely to recur.
- d. Notwithstanding Article 4 of the Agreement, Contractor acknowledges and agrees that its failure to comply with this requirement justifies the imposition of liquidated damages in an amount equal to Contractor's net profit, or five percent (5%) of the total contract amount, whichever is greater.
 1. Liquidated damages under this provision shall be payable to the City upon demand and may be set off against any monies due to the Contractor from any contract with the City.

3. VIRGIN REDWOOD

- a. Contractor agrees to comply with the City Council's October 29, 1996, directive not to purchase virgin redwood for the prosecution of the work to be done under this Contract and in its place purchase and use:
 1. Redwood that has been previously used or;

2. Certified, sustainable-harvested redwood as the preferred alternative to virgin and non-certified redwood, and not pressure-treated lumber of other species as an alternative to redwood."

4. TREATED WOOD

- a. Contractor shall comply with the terms of Resolution No. 61,724-N.S. (Appendix 00812-E) prohibiting the use of Pentachlorophenol, arsenic and creosote treated wood. No such wood shall be used by the contractor in this or any other City project without the express written consent of the City Council.

1.07 COMMUNITY WORKFORCE AGREEMENT. The following paragraph shall be added to Document 00 7200 (General Conditions) as a new Section if the contract exceeds \$500,000.

"16.F COMMUNITY WORKFORCE AGREEMENT

1. Contractor and any subcontractor at any tier shall comply with the City's Community Workforce Agreement set forth in the Appendix 00812 C.
 - a. Under the Community Workforce Agreement, Contractor must sign and comply with the Agreement to be Bound prior to execution of the Contract.
 - b. Subcontractors at any tier must also sign and comply with an Agreement to be Bound prior to execution of their respective subcontracts.
 - c. The signing of an Agreement to be Bound is a condition precedent to entering into any contract for this project."

1.08 EQUAL BENEFITS ORDINANCE. The following paragraph shall be added to Document 00 7200 (General Conditions) as a new Section:

"16.G EQUAL BENEFITS ORDINANCE:

1. Contractor hereby agrees to comply with the provisions of the Berkeley Equal Benefits Ordinance, B.M.C. Chapter 13.29 (Appendix 00812-D). If Contractor is currently subject to the Berkeley Equal Benefits Ordinance, as indicated by the Equal Benefits Certification form, as contained in Document 00680, Contractor will be required to provide all eligible employees with City mandated equal benefits, as defined in B.M.C. Chapter 13.29, during the term of this contract, as well as comply with the terms enumerated herein.
2. If Contractor is currently or becomes subject to the Berkeley Equal Benefits Ordinance, Contractor agrees to provide the City with all records the City deems necessary to determine compliance with this provision. These records are expressly subject to the auditing terms described in Document 00 7200, General Conditions, Article 8.02.
3. If Contractor fails to comply with the requirements of this Article, City shall have the rights and remedies described in this Section, in addition to any rights and remedies provided by law or equity.
3. Contractor's failure to comply with this Article shall constitute a material breach of the Contract, upon which City may terminate the Contractor's right to proceed with the Work pursuant to Document 00 7200, General

Conditions, Article 14.05. In the event the City terminates the Contractor's right to proceed with the Work due to a default by Contractor under this Article, the City may deem Contractor a non-responsible bidder for not more than five (5) years from the date this Contract is terminated. In addition, at City's sole discretion, Contractor may be responsible for liquidated damages in the amount of \$50.00 per employee per day for each and every instance of violation of this Section. It is mutually understood and agreed that Contractor's failure to provide its employees with equal benefits will result in damages being sustained by City; that the nature and amount of these damages will be extremely difficult and impractical to fix; that the liquidated damages set forth herein is the nearest and most exact measure of damages for such breach that can be fixed at this time; and that the liquidated damage amount is not intended as a penalty or forfeiture for Contractor's breach. City may deduct any assessed liquidated damages from any payments otherwise due Contractor.

1.09 SANCTUARY CITY CONTRACTING: The following paragraph shall be added to Document 00 7200 (General Conditions) as a new Section:

"16. H SANCTUARY CITY ORDINANCE:

1. Contractor hereby agrees to comply with the provisions of the Sanctuary City Contracting Ordinance, B.M.C. Chapter 13.105. In accordance with this Chapter, Contractor agrees not to provide the U.S. Immigration and Customs Enforcement Division of the United States Department of Homeland Security with any Data Broker or Extreme Vetting Services as defined herein:
 - a. "Data Broker" means either of the following:
 - ii. The collection of information, including personal information about consumers, from a wide variety of sources for the purposes of reselling such information to their customers, which include both private-sector business and government agencies;
 - iii. The aggregation of data that was collected for another purpose from that for which it is ultimately used.
 - b. "Extreme Vetting" means data mining, threat modeling, predictive risk analysis, or other similar services. Extreme Vetting does not include:
 - i. The City's computer-network health and performance tools;
 - ii. Cybersecurity capabilities, technologies and systems used by the City of Berkeley Department of Information Technology to predict, monitor for, prevent, and protect technology infrastructure and systems owned and operated by the City of Berkeley from potential cybersecurity events and cyber-forensic based investigations and prosecutions of illegal computer based activity."

SCHEDULE OF APPENDENCES
TO
MODIFICATIONS TO GENERAL CONDITIONS

Schedule of Exhibits: (the following Exhibits are on file at the Berkeley City Clerk's office and will be made available on request to any interested party)

- A. City Council Resolution No. 59,853-N.S. (Re: Oppressive States).
- B. City Council Resolution No. 58,291-N.S. (Re: Tropical Hardwoods).
- C. City Council Resolution No. 61,724-N.S. (Re: Treated Wood).
- D. Berkeley Municipal Code, Chapter 13.29, Equal Benefits Ordinance
- E. Community Workforce Agreement and Agreement to be Bound for contract exceeding \$500,000.
- F. Sanctuary City Contracting Ordinance, B.M.C. Chapter 13.105.

END OF DOCUMENT

DOCUMENT 00 7319

**SUPPLEMENTARY CONDITIONS – HEALTH AND SAFETY REQUIREMENTS;
HAZARDOUS MATERIALS**

ARTICLE 1 – GENERAL

1.01 Summary

- A. This document includes requirements as they apply to location, removal, remediation and disposal of hazardous materials and hazardous waste.

1.02 HAZARDOUS MATERIALS SURVEY

- A. Reference Section 01 1100, Part 1.15 for a list of available documents, including any Hazardous Materials Surveys, if available.
- B. Data regarding the locations of hazardous materials was obtained only for use of City and its consultants, contractors, and tenants for planning and design and are not part of Contract Documents.
- C. Bidders may rely on this data and information for general accuracy regarding the locations of potentially hazardous materials subject of the Work. City does not warrant and makes no representation regarding the completeness or thoroughness of any data or information regarding existing conditions or hazardous materials, including, but not limited to, quantities, characteristics, volumes, or associated structural features. Bidder represents and agrees that in submitting a Bid it is not relying on any such data, information or deductions.
- D. Before submitting a Bid, each Bidder shall be responsible to obtain such 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, which may affect cost, progress, performance or furnishing of Work or which 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 which 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.
- E. Bidders shall advise City in writing during the Bid period of any questions, suppositions, inferences or deductions Bidders may have for City's review and response. City has provided time in the period prior to bidding for Bidder to perform these investigations.
- F. During the Pre-Bid Site Visit(s), City 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 conditions upon completion of such explorations, investigations, tests, and studies. Such investigations may be performed only under the provisions of Document 00 2113 (Instructions to Bidders) and Document 00 7200 (General Conditions) including, but not limited to, proof of insurance and obligation to indemnify against claims arising from such investigation work. Each Bidder shall supply all equipment required to perform any investigations as each Bidder deems necessary. City has the right to limit the number of pieces of machinery operating at one time due to safety concerns.

1.03 Precedence of Documents

- A. Should any provision or requirement of any Contract Document conflict with another provision or requirement in the Contract Documents on subject matters of hazardous waste abatement, clean up, disposal, or required safety standards or methods, then the most stringent provision or requirement shall control.

1.04 Means and Methods of Construction

- A. Nothing contained in these Contract Documents or inferable therefrom shall be deemed or construed (1) to make Contractor the agent, servant or employee of City, or (2) to create any partnership, joint venture or other association between City and Contractor.

1.05 Control of the Work

- A. City shall exercise administration of the Contract. The City may employ a consultant to assist. City reserves the right to assign or delegate to this consultant, or any other consultant ("Consultant") any or all of the responsibilities of the Architect/Engineer under the Contract Documents, or alternatively, to act as City's representative.
- B. Contractor shall cooperate with Consultant as directed by City. Consultant's duties may include observing the Contractor's health and safety program and practices, observing the abatement construction activities, observing the contractor's abatement work practices for compliance with the Contract Documents, observing the extent of material removed from each job site, reviewing payment requests, reviewing reports required by governmental or quasi-governmental agencies or the Contract Documents, and providing clearance tests after abatement is completed. No action, omission to act, approval, or failure to advise Contractor as to any matter by Consultant shall in any way relieve the Contractor from its responsibility for the performance of the Work in strict accordance with the Contract Documents and applicable Law.

1.06 Warranty, Guarantee and Inspection of Work.

- 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 Law and contract 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 adequately address 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 this contract, and prior 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 requirements.
- D. City 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 statutory 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 of public and quasi-public entities having jurisdiction.
- E. Contractor acknowledges that City also 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, provided that City shall have no obligation to perform said 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 City elects to perform these activities and tests, Contractor shall afford City 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 for tests by City in the Contract Sum and the Scheduled Completion

Date. Contractor shall not be entitled to increases in the contract sum or any damages for delay in the event City elects to perform these activities and tests, provided any delays resulting therefrom are reasonable under the circumstances involved. Notwithstanding City's rights granted by this paragraph, Contractor shall retain its own industrial hygiene consultant and shall have primary responsibility for collecting samples and perform all applicable, relevant or appropriate activities and tests including, but not limited to, pre-abatement, during abatement and post-abatement air monitoring, required or suggested by the Contract Documents, the Law, or both, and City reserves the right to request documentation of all such activities and tests performed by Contractor relating to the Work.

1.07 RECORDS

- A. Contractor shall obtain and maintain and shall furnish to City on completion of the Work, or at any other time requested by City, all necessary permits, licenses, approvals, authorizations, notifications, training certificates, respirator certificates, reports, correspondence, test results, air monitoring certificates, forms, medical records, medical certificates, notes and photographs of work conditions, approved shipping and disposal facility receipts, manifests, and all other documentation required by the Contract Documents or applicable Law, or both.
- B. Contractor shall provide City with copies of each such document as it is generated and shall, as a condition to final payment, provide City with a complete set of such documents (bound, organized and indexed) at the conclusion of the Work. Contractor shall keep and maintain in retrievable files true and correct copies of all such documents for a period of not less than thirty (30) years after final completion of the Work. City shall have the right to inspect or photocopy these records and, if Contractor should cease business operations, then it shall furnish these records to City.

1.08 Compliance with laws

- A. Contractor represents that it is familiar with 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 (collectively, the "Law") relating to:
 1. the protection of the public health, welfare and environment;
 2. storage, handling or use of asbestos, PCB, lead, petroleum based products or other hazardous materials;
 3. the generation, processing, treatment, storage, transport, disposal, destruction or other management of asbestos, PCB, lead, petroleum or hazardous waste materials or other waste materials of any kind; or,
 4. the protection of environmentally sensitive areas such as wetlands.
- B. Contractor has the sole responsibility for determining current waste storage, handling, transportation and disposal regulations for the jobsite and for each waste disposal facility. Contractor must comply fully at its sole cost and expense with these regulations and any applicable Law. City, may, but is not obligated to, require submittals with this information for it to review consistent with the Contract Documents.
- C. Contractor shall develop and implement a system acceptable to City to track hazardous waste from the site to disposals, including appropriate "Hazardous Waste Manifests" on the EPA form, so that City may track the volume of waste it put in each landfill and receive from each landfill a certificate of receipt.
- D. Contractor shall provide City with the name and address of each waste disposal facility prior to any disposal, and City shall have the express right to reject any proposed disposal facility. Contractor shall not use any disposal facility to which City 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 general contractor.

1.09 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 City 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 like. For example, before commencing any work in connection with the Work involving asbestos-containing materials or PCB 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 City. Contractor shall not conduct any Work involving asbestos-containing materials or PCB unless Contractor has first confirmed that the appropriate agency having jurisdiction is in receipt of the required notification. All permits, licenses, bonds required by governmental or quasi-governmental authorities, fees, deposits, tap fees, offsite easements and asbestos and PCB disposal facilities necessary for the prosecution of the Work shall be procured and paid for by Contractor. Contractor shall give all notices and comply with the Law 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 City in writing of such fact. If Contractor performs any Work contrary to the Law without such notice to City, it shall bear all costs arising therefrom.

- B. In the case of any permits or notices held in City's name or of necessity to be made in City's name, City shall cooperate with Contractor in securing the permit or giving the notice, but the Contractor shall prepare for City's review and execution upon approval, all necessary applications, notices and other materials.

1.10 Indemnification and Termination

- A. To the 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 liabilities connected to the selection and use of a waste disposal facility, personal injury, property damage, loss of use of property, damage to 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.*)
- B. Notwithstanding anything in Document 00 7200 to the contrary, City shall have an absolute right to terminate the Contractor's right to proceed with the Work for cause immediately, without ten calendar days notice and without an opportunity to cure, should Contractor knowingly or recklessly commit a material breach of the terms of the Contract Documents or the 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 in Document 00 7200, Article 14.05, shall apply without modification.

1.11 Protection of Work, Persons and Property

- 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 Law (as herein defined), 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.

END OF DOCUMENT

DOCUMENT 00 7380

APPRENTICESHIP PROGRAM

ARTICLE 1 – COMPLIANCE REQUIRED

- 1.01** Contractor and Subcontractors shall comply with the requirements of California Labor Code §§1776, 1777.5, and 1777.6 concerning the employment of apprentices by Contractor or Subcontractors. Willful failure to comply may result in penalties, including loss of the right to Bid on or receive public works contracts.

ARTICLE 2 – CERTIFICATION OF APPROVAL

- 2.01** California Labor Code §1777.5, as amended, requires a Contractor or Subcontractor employing tradespersons in any apprenticeable occupation to apply to the joint apprenticeship committee nearest the site of a public works project and which administers the apprenticeship program in that trade for a certification of approval. The certificate shall also fix the ratio of apprentices to journeypersons that will be used in performance of the Contract. The ratio of work performed by apprentices to journeypersons in such cases shall not be less than one *hour* of apprentices work for every five *hours* of labor performed by journeypersons (the minimum ratio for the land surveyor classification shall not be less than one apprentice for each five journeypersons), except:
- A. When unemployment for the previous three month period in the area exceeds an average of 15 percent;
 - B. When the number of apprentices in training in the area exceeds a ratio of one to five;
 - C. When a trade can show that it is replacing at least 1/30 of its membership through apprenticeship training on an annual basis state-wide or locally; or
 - D. Assignment of an apprentice to any work performed under a public works contract would create a condition which would jeopardize his or her life or the life, safety, or property of fellow employees or the public at large or if the specific task to which the apprentice is to be assigned is of such a nature that training cannot be provided by a journeyperson.

ARTICLE 3 – FUND CONTRIBUTIONS

- 3.01** Contractor is required to make contributions to funds established for administration of apprenticeship programs if Contractor employs registered apprentices or journeypersons in any apprenticeable trade on such contracts and if other contractors on the public works site are making such contributions.

ARTICLE 4 – APPRENTICESHIP STANDARDS

- 4.01** Information relative to apprenticeship standards, wage schedules, and other requirements may be obtained from the Director of the California Department of Industrial Relations, or from the Division of Apprenticeship Standards and its branch offices.

END OF DOCUMENT

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DOCUMENT 00 9113

ADDENDA

SPECIFICATION NO. 24-11654-C

CITY OF BERKELEY

FIRE WAREHOUSE INTERIOR AND SITE IMPROVEMENT PROJECT

1011 FOLGER AVENUE

The following Addenda were issued, modifying the Project Manual:

Addendum No. 1, issued on **August 19, 2024**

Addendum No. 2, issued on **August 23, 2024**

END OF DOCUMENT

ADDENDUM NO. 1
August 19, 2024

The bid documents for Specification No. 24-11654-C for the Fire Warehouse Interior and Site Improvement Project are amended as follows:

1-1.DOCUMENT 00 4113-1 - SCHEDULE OF BID PRICES
1-2.DOCUMENT 01 1100-2 - ALLOWANCES

QUESTIONS AND RESPONSES:

2-1. Is the Pre-Bid Site Visit Mandatory?

City Response: No.

2-2. What type of License do you need to bid the project?

City Response: Contractor "B" license.

2-3. When do you expect construction to commence?

City Response: Winter/Spring 2025.

2-4. Will the new accessible path require traffic rated concrete?

City Response: Yes.

2.5. Is a new PG&E service required?

City Response: Yes, 3 phase power.

2.6. Will storage & staging space be available on site?

City Response: Yes, space can be made available & coordinated with fire department.

2.7. Which refrigerant standard should we follow for this bid, considering that construction is planned for 2025 and R410A will be banned after December 2024?

City Response: Submit your bid based on the refrigerants currently available and as specified in the specs. Include an allowance. Refer to Schedule of Bid Prices (#4113-2).

2.8 What size will the slide-in bollards shown on A2.01 be?

City Response: Bollards are to be 4" diameter. A 6" deep and 5" diameter core in the existing concrete slab on grade will be required. Cores should be located such that none of the existing rebar in the slab on grade is damaged or cut; cores to be spaced no closer than 5' on center

2.9 No reference is made to either Phase I or Phase II CARB gasoline vapor recovery Executive Orders. Please know that the 300 gallon compartment for gasoline will require your project to meet CARB Executive Order VR501-E for Phase II vapor recovery. The HIRT system is the only vapor recovery system authorized for Aboveground Gasoline Storage Tanks. Will the tank need the Phase II CARB vapor recovery system?

City Response: No, fleet is ORVR certified and will be exempt.

END OF DOCUMENT

ADDENDUM NO. 2
August 23, 2024

The bid documents for Specification No. 24-11654-C for the Fire Warehouse Interior and Site Improvement Project are amended as follows:

1-1.DOCUMENT 00 4113-1 - SCHEDULE OF BID PRICES

1-2.DOCUMENT 01 1100-2 - ALLOWANCES

QUESTIONS AND RESPONSES:

2-1.Is there a preferred allowance amount for Bid item 5 – 2025 Refrigerant Changes?

City response: \$25,000

2-2.Would you happen to know if all of the permits (fire & environmental health permits) have been pulled for the fuel storage tank or is the contractor responsible for pulling the additional permits?

City response: Some of the required permits are tied to the building permit but the City will file additional required permits.

END OF DOCUMENT

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DIVISION 1 GENERAL REQUIREMENTS

SECTION 01 1100**SUMMARY OF WORK****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes Summary of Work and Work Restrictions including:
 - 1. Work Covered By Contract Documents
 - 2. Bid Item, Allowances and Alternates
 - 3. Contract Document Organization
 - 4. Maintenance
 - 5. Work Under Other Contracts
 - 6. Future Work
 - 7. Work Sequence
 - 8. Work Days and Hours
 - 9. Shutdown for Discovery of Cultural Resources
 - 10. Cooperation of Contractor and Coordination with Other Work
 - 11. Partial Occupancy/Utilization Requirements
 - 12. Contractor Use of Site
 - 13. Air Quality Standards
 - 14. Construction Staking, Monument Protection and Replacement
 - 15. Geotechnical Data and Existing Conditions
 - 16. Protection of Existing Structures and Underground Facilities
 - 17. Permits
 - 18. Actual Damages for Permit Violations
 - 19. Reference Standards
 - 20. Products Ordered in Advance
 - 21. City-Furnished Products

1.02 WORK COVERED BY CONTRACT DOCUMENTS

- A. Work comprises of the construction of City's **Fire Warehouse Interior and Site Improvement Project** located at **1011 Folger Avenue**. The Work includes, without limitation, **Interior upgrades and site improvements to the Fire Warehouse**. Contract Documents fully describe the Work.
- B. The Work of this Contract comprises construction of all the Work indicated, described in the Specifications, or otherwise required by the Contract Documents. Unless provided otherwise in the Contract Documents, all risk of loss to Work covered by Contract Documents shall rest with Contractor until Final Acceptance of the Work. Cost of maintenance of systems and equipment prior to Final Acceptance will be considered as included in prices Bid and no direct or additional payment will be made therefore.
- C. For all Bid items, furnish and install all Work, including connections to existing systems, indicated and described in Specifications and all other Contract Documents. Work and requirements applicable to each individual Bid item, or unit of Work, shall be deemed incorporated into the description of each Bid item (whether Lump Sum or Unit Price). Any Bid item may be deleted from the Work and Contract Sum, in total or in part, prior to or after award of Contract without compensation in any form or adjustment of other Bid items or prices therefore.
- D. Allowance Work shall be done as Change Orders and as specified in Section 01 2600 (Modification Procedures). Identify Allowance Items (See Document 00 4113 [Bid Form]) work on

the Progress Schedules and on Applications for Payment. The Amount given on Document 00 4113 (Bid Form) under each Allowance Item is the sum of money set aside for each Allowance Item. These amounts shall be included in the Contract Sum on the Bid Form. If the cost of Work done under any Allowance Item is less than the amount given on the Bid Form under that Allowance Item, the Contract Sum shall be reduced by the difference between the amount given in the Bid Form and the cost of Work actually done.

1.03 BID ITEMS, ALLOWANCES AND ALTERNATES

- A. Descriptions of Lump Sum Items (listed by Bid item numbers):

All labor, materials, services, and equipment necessary for the completion of all of the work in accordance to the Contract Documents.

- B. Descriptions of Unit Price Items and Basis of Measurement for Payment (listed by Bid item numbers):

N/A

- C. Allowances:

1. Scope of Allowances:

Bid Item 5: 2025 Refrigerant Changes – The bid allowance for the 2025 refrigerant changes should equal the sum of \$25,000.

- D. Bid Alternates: **N/A**

1.04 CONTRACT DOCUMENT ORGANIZATION

- A. The Drawings illustrate locations, arrangements, dimensions, and details to determine the general character of the Work. Parts not detailed shall be subject to the Architect's approval. Where reasonably inferable that a Drawing illustrates only part of a given work on a number of items, the remainder shall be deemed repetitious and so construed. Drawings of greater scale take precedence over Drawings of lesser scale. Do not scale documents.
- B. Drawings indicate general arrangement and location of such items as piping, conduit, apparatus, and equipment. Drawings and Specifications are for guidance of the Contractor and exact locations, distances, and levels will be governed by building site and actual building conditions. The Contractor shall make minor changes, as directed, to arrangements or locations shown in order to meet Structural or Architectural conditions.
- C. Specifications describe performances and qualities required of materials and of methods. Items listed under each Section of the Specifications are not necessarily all inclusive. The Contractor shall be responsible for the complete work.
- D. For convenience, Specifications are separated into topical divisions of work, each of which is further related to topical divisions under which it occurs. Such separation shall not be construed as an attempt by the Architect to establish limits of any agreements between the Contractor and his/her subcontractors.
- E. Portions of these Specifications are of abbreviated, simplified type and may include incomplete sentences.
1. Omissions of words or phrases such as "the Contractor shall", "in conformity with", "shall be", "as noted on the Drawings", "in accordance with the details", "a", "the", "all", "any", and "each" are intentional. Omitted words or phrases shall be supplied by inference.
 2. Terms such as "approved", "or approved equal", "as directed", "as required", "as provided", "acceptable", and "satisfactory" mean by or to the Architect or the City.
 3. Furnish: The term furnish means supply and deliver to the Project Site, ready for unloading, unpacking, assembly, installation, and similar operations.
 4. Install: The term install describes operations at the Project Site, including the actual unloading,

unpacking, assembly, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar ions.

5. Provide: The term provide means to furnish and install, complete and ready for the intended use.

F. Reference Standards

1. For products specified by association or trade standards, comply with requirements of the standard except where more rigid requirements are specified or are required by applicable codes.
2. The date of the standard is that in effect as of bid date except where specific date is specified

1.05 MAINTENANCE

- A. Cost of maintenance of systems and equipment prior to Final Acceptance will be considered as included in prices bid and no direct or additional payment will be made therefor.

1.06 WORK UNDER OTHER CONTRACTS

- A. None expected

1.07 FUTURE WORK

- A. None expected

1.08 WORK SEQUENCE

- A. Construct Work in stages and at times to accommodate City operation requirements during the construction period; coordinate construction schedule and operations with City.

B. Special operational constraints include the following:

1. None expected

1.09 WORK DAYS AND HOURS

- A. Work Days and hours: Monday-Friday inclusive, **7:00 a.m.-5:00 p.m.** local time.
- B. Work at the Site on weekends or holidays is not permitted, unless Contractor requests otherwise from City in writing at least 48 hours in advance and City approves in its sole discretion.

1.10 SHUTDOWN FOR DISCOVERY OF CULTURAL RESOURCES

- A. If discovery is made of items of historical archaeological or paleontological interest, immediately cease all Work in the area of discovery. Archaeological indicators may include, but are not limited to, dwelling sites, locally darkened soils, stone implements or other artifacts, fragments of glass or ceramics, animal bones, human bones, and fossils. After cessation of excavation, immediately contact City. Do not resume Work until authorization is received from City. When resumed, excavation or other activities shall be as directed by City.

1.11 COOPERATION OF CONTRACTOR AND COORDINATION WITH OTHER WORK

- A. Coordinate with City and any City forces, or other contractors and forces, as required by Document 00 7200 (General Conditions).

1.12 PARTIAL OCCUPANCY/UTILIZATION REQUIREMENTS

- A. Allow City to take possession of and use any completed or partially completed portion of the Work during the progress of the Work as soon as is possible without interference to the Work.
- B. Possession, use of Work, and placement and installation of equipment by City shall not in any way evidence the completion of the Work or any part of it.
- C. Contractor shall not be held responsible for damage to the occupied part of the Work resulting from City occupancy.

- D. Make available, in areas occupied, on a 24 hour per day and 7 day per week basis if required, any utility services, heating, and cooling in condition to be put in operation at the time of occupancy.
 - 1. Responsibility for operation and maintenance of said equipment shall remain with Contractor.
 - 2. Make, and City shall certify, an itemized list of each piece of equipment so operated with the date operation commences.
 - 3. Itemized list noted above shall be basis for commencement of warranty period for equipment.
 - 4. City shall pay for utility cost arising out of occupancy by City during construction.
- E. Use and occupancy by City prior to acceptance of Work does not relieve Contractor of its responsibility to maintain insurance and bonds required under the Contract until entire Work is completed and accepted by City.
- F. Prior to date of Final Acceptance of the Work by City, all necessary repairs or renewals in Work or part thereof so used, not due to ordinary wear and tear, but due to Defective materials or workmanship or to operations of Contractor, shall be made at expense of Contractor, as required in Document 00 7200 (General Conditions).
- G. Use by City of Work or part thereof as contemplated by this Section 01 1100 shall in no case be construed as constituting acceptance of Work or any part thereof. Such use shall neither relieve Contractor of any responsibilities under Contract, nor act as waiver by City of any of the conditions thereof.
- H. City may specify in the Contract Documents that portions of the Work, including electrical and mechanical systems or separate structures, shall be substantially completed on dates described in this Section 01 1100, if any, prior to Substantial Completion of all of the Work. Notify City in writing when Contractor considers any such part of the Work ready for its intended use and Substantially Complete and request City to issue a Certificate of Substantial Completion for that part of the Work.

1.13 CONTRACTOR USE OF SITE

- A. Access is available to the Site from **1011 Folger Ave**. The facility has an electric powered gate that can be unlocked from the facility.
- B. **For work in City building]** Contractor shall contact City at least 2 Business Days prior to entering the building and performing Work to allow City to arrange access into the building. Access Request forms shall be submitted 48 hours in advance of anticipated on-site Work to gain permission to enter Site and to allow notification to occupants.
- C. Confine operations at Site to areas permitted by Contract Documents, permits, ordinances, and laws. Do not unreasonably encumber Site with materials or equipment.
- D. Assume full responsibility for protection and safekeeping of products stored on premises. Move any stored products that interfere with operations of City or other contractor.
- E. Coordinate parking, storage, staging, and Work areas with City. City will review and approve the proposed storage area for Contractor's equipment and materials. Do not store construction materials in the dripline of any tree.
- F. Prior to commencement of Work or excavation, Contractor and City shall jointly survey the area adjacent to the Project area making permanent note and record of such existing damage such as cracks, sags or other similar damage. This record shall serve as a basis for determination of subsequent damage to structures, conditions or other existing improvements due to Contractor's operations. All parties making the survey shall sign the official record of existing damage. Cracks, sags or damage of any nature to the adjacent Project area, not noted in the original survey but subsequently noted, shall be reported immediately to City.
- G. The Contractor shall follow all city ordinances in force during the duration of this Contract.

- H. It is essential that the Contractor perform the Work with as little interference and disturbance as possible to the surrounding neighborhood.
- I. When suspect materials, outside the scope of Work, are encountered during the Work or restoration process, the Contractor shall immediately contact the Project Manager for evaluation and approval of the methods for dealing with the material.

1.14 AIR QUALITY STANDARDS

- A. Ensure that idling time for all heavy equipment is minimized to reduce on-Site emissions.
- B. Maintain equipment in good mechanical condition.
- C. Cover trucks hauling dirt.
- D. Limit dust emissions during periods of high winds (greater than 15 miles per hour).
- E. Replace ground cover in disturbed areas as soon as possible.
- F. Enclose, cover, water, or apply soil binders to exposed stockpiles.
- G. Remove earth tracked onto neighboring paved roads at least once daily.
- H. Limit equipment speed to 10 miles per hour in unpaved areas.

1.15 CONSTRUCTION STAKING, MONUMENT PROTECTION AND REPLACEMENT

- A. Notify City at least three (3) Business Days prior to the need for initial staking. City will provide engineering surveys, City benchmarks, corner records, reference points, and/or monument cards that in City's judgment are necessary to establish site elevations for the Contractor to establish construction stakes in order to enable Contractor to proceed with the Work.
- B. If Contractor finds any additional information is necessary, notify City in writing 2 Business Days in advance. City shall have no liability for any inadequacy unless Contractor notifies City and City fails to cure within 3 Business Days of such notice.
- C. Contractor shall be responsible for laying out the Work and provide all construction staking. Contractor shall replace or repair construction stakes at own expense.
- D. Contractor shall perform brush clearing and traffic control, as necessary, in City's sole judgment.
- E. The Contractor shall protect and preserve all existing survey monuments, benchmarks, reference points, property monuments and stakes.
- F. Whenever Contractor knows or reasonably should know that any Work activity is likely to damage or destroy any survey monuments, benchmarks, reference points, property monuments, or construction stakes, or require relocation because of necessary changes in grades or locations, provide at least 3 Business Days advance notice to City. Survey monuments, benchmarks, reference points and property monuments shall not be disturbed until authorized by the City.
- G. Whenever the Contractor disturbs or removes any survey monuments, benchmarks, reference points, or property monuments, the Contractor shall replace the monument in accordance with City Standard Plan 8090 or City Standard Plan 8091, as applicable. Standard Plans are available upon request. Monument casings (boxes and lids) shall be provided by the Contractor, and dome brass markers shall be supplied by the City.
- H. In the event that any non-referenced monuments become in danger of being disturbed due to construction, the Contractor shall cease the threatening activity and notify the City immediately. Response to endangered monuments is a priority call, and each monument shall be referenced in accordance with the City of Berkeley Monument Reference Guidelines, available upon request. In no case may an unreferenced monument be damaged during construction.
- I. Should any monument not designated for replacement sustain damage during construction, the Contractor shall bear the expense for rebuilding it as well as for the survey work the City survey crew or its survey consultant must perform in the process. In any instance where the City deems

a damaged monument to be irreplaceable, the contractor shall be fined \$20,000 per monument.

- J. Monument replacement must be done in a neat, workman-like manner. Pavement cuts shall be accurate, with vertical cuts to exact dimensions as shown on the Standard Plans. Monument boxes and lids shall be placed at the proper finished grade and as detailed by Standard Plan 8090 or Standard Plan 8091. Existing monument lids shall be salvaged by the Contractor and delivered to the City.
- K. Each replacement monument shall be constructed such that the center of the dome brass marker is set within 0.04 foot of the referenced position. The new dome brass marker shall not receive final punching prior to seven (7) calendar days after completion of the monument construction.
- L. In any event, notify City whenever any survey monuments, benchmarks, reference points, or property monuments are lost or destroyed or require relocation because of necessary changes in grades or locations.
- M. If the City has elected to reference known monuments around or within the project site, a copy of the corner records for the referenced monuments shall be provided to the Contractor prior to the start of construction. For each monument that has been disturbed or removed, the replacement monument location(s) will be established by the City's survey crew or its survey consultant after final pavement is completed and upon request by the Contractor.
- N. All City of Berkeley Monuments located within the project area must be referenced, prior to work commencing, by a licensed land surveyor as required by Section 8771 of the Business and Professions Code. Corner Records of this work must be submitted for filing to both the County Surveyor of Alameda County, and the City of Berkeley, Public Works Department, Engineering Division, Survey Section.
- O. Illegible survey requests or requests without proper notification (at least 3 Business Days in advance), may result in delayed response. No extension of Contract Time will be allowed due to such delays.

1.16 GEOTECHNICAL DATA AND EXISTING CONDITIONS

- A. Available Documentation: In accordance with, and subject to, the provisions of Document 00 3132 (Geotechnical Data and Existing Conditions), the following documentation is available for review. This information is not part of the Contract Documents.

1. **N.A**

1.17 PROTECTION OF EXISTING STRUCTURES AND UNDERGROUND FACILITIES

- A. The Drawings may indicate existing above- and below-grade structures, drainage lines, storm drains, sewers, water lines, gas lines, electrical lines, hot water lines, and other similar items and Underground Facilities that are known to City. At least (2) two Business Days, or as otherwise noted, prior to commencement of excavation, notify the owners of the following Underground Facilities:
 1. **Water lines:** EBMUD
 2. **Sewer lines:** Berkeley Public Works Department
 3. **Telephone Conduit:** Telephone Provider
 4. **Cable:** Cable Provider
 5. **Electrical Lines:** PG&E
- B. Where overhead service to a structure, known to receive service, does not exist, then underground service shall be assumed to exist.
- C. Attention is also directed to the existence of overhead power and telephone lines.
- D. Perform pot-holing by hand within 24 inches (in any direction) of the Underground Facilities. This may be done on an area-by-area basis, but shall be accomplished at least 7 calendar days in

- advance of the date of construction within such area.
- E. Telemetry antennas: Ensure that the telemetry and voice communication antennas located on the [Identify the Building] roof remain operational. City's telemetry system is critical to the function and operation of Owner's water supply and distribution system. Coordinate relocation of equipment related to the telemetry and voice communication systems with Owner. Notify Owner 3 calendar days prior to conducting any Work in the vicinity of the telemetry antenna.
 - F. No attempt has been made to locate utilities on private property such as sprinkler irrigation systems or electrical conduits on the project site or adjacent property. Contractor is responsible for contacting all property owners as necessary, and locating and marking utilities in the vicinity of the work prior to construction.
 - G. In addition to reporting, if a utility is damaged, Contractor must take appropriate action as provided in Document 00 7200 (General Conditions).
 - H. Additional compensation or extension of time on account of utilities not indicated or otherwise brought to Contractor's attention including reasonable action taken to protect or repair damage shall be determined as provided in Document 00 7200 (General Conditions).

1.18 PERMITS

- A. Permits, agreements, or written authorizations that are known by City to apply to this Project are listed below:
 - 1. Storm Water Pollution Prevention
 - 2. Cal/OSHA Permit. Obtain, as applicable, permit(s) as required by Cal/OSHA for the following:
 - a. Construction of trenches or excavations that are five feet or more in depth and into which a person is required to descend.
 - b. Construction or demolition of any building, structure, or scaffolding for falsework more than three stories high, or the equivalent height (36 feet).
 - c. Erection or dismantling of vertical shoring systems more than three stories high, or the equivalent height (36 feet).
 - 3. The local Cal/OSHA district office is located at:

CAL/OSHA Headquarters
1515 Clay Street, Suite 1901
Oakland, CA 94612
(510) 286-7037

- B. All other permits that may be required, such as electrical, mechanical, fire prevention, irrigation, grading, slope protection, tree cutting, etc., have not been applied for and shall be obtained by Contractor. Applicable permit fees will be reimbursed to the extent specified in Document 00 7200 (General Conditions).

1.19 ACTUAL DAMAGES FOR PERMIT VIOLATIONS

- A. In addition to damages which are impracticable or extremely difficult to determine, for which liquidated damages will be assessed as described in Document 00 5200 (Agreement) and Document 00 7200 (General Conditions), City may incur actual damages, including fines imposed by any regulatory agency, resulting from use in violation of legal or regulatory requirements where the violations result from Contractor's activities. Continuous operation in compliance with legal or regulatory requirements is essential to avoid discharges that would violate applicable regulations. Violations or threatened violations may subject City to fines or occurrence and/or other costs or civil liabilities.
- B. Contractor shall be liable for and shall pay City the amount of any actual losses in addition to liquidated damages or other remedies provided by the Contract Documents.

- C. The amount of liquidated damages provided in Document 00 5200 (Agreement) and Document 00 7200 (General Conditions) is not intended to include, nor does the amount include, any damages incurred by City for reasons other than those listed in that paragraph. Any money due or to become due to Contractor may be retained by City to cover both the liquidated and the actual damages described above and, should such money not be sufficient to cover such damages, City shall have the right to recover the balance from Contractor or its sureties.

PART 2 - PRODUCTS

2.01 REFERENCE STANDARDS

- A. For products specified by association or trade standards, comply with requirements of standard, except where more rigid requirements are specified or are required by applicable codes.

2.02 PRODUCTS ORDERED IN ADVANCE

- A. As provided in Document 00 7200 (General Conditions) and Section 01 2000 (Measurement and Payment), and subject to all other provisions of the Contract Documents, City will pay for the following materials and equipment prior to incorporation into the Work:

1. **None**

2.03 CITY-FURNISHED PRODUCTS

- A. City-Furnished Products:

1. **None**

- B. City's Responsibilities:

1. Arrange for and deliver City-reviewed Shop Drawings, Product Data, and Samples, to Contractor.
2. Arrange and pay for delivery to Site.
3. On delivery, inspect products jointly with Contractor.
4. Submit claims for transportation damage and replace damaged, Defective, or deficient items.
5. Arrange for manufacturers' warranties, inspections, and service.

- C. Contractor's Responsibilities:

1. Review City-reviewed Shop Drawings, Product Data, and Samples.
2. Receive and unload products at Site; inspect for completeness or damage jointly with City.
3. Handle, store, install, and finish products.
4. Repair or replace items damaged after receipt.
5. Install into Project per Contract Documents.

PART 3 - EXECUTION – NOT USED

END OF SECTION

DIVISION 1 GENERAL REQUIREMENTS**SECTION 01 2000****MEASUREMENT AND PAYMENT****PART 1 - GENERAL****3.01 SUMMARY**

- A. Section includes description of requirements and procedures for determining amount of Work performed and for obtaining payment for Work performed.

3.02 REFERENCES

- A. California Public Contract Code
- B. Code of Civil Procedures
- C. Government Code

3.03 COMPOSITION AND SCOPE OF CONTRACT SUM**A. Scope of Contract Sum**

1. The Contract Sum for performance of the Work under Contract Documents, or under any Bid item, allowance, or Alternate, shall include full compensation for all Work required under the Contract Documents, including without limitation, all labor, materials, taxes, transport, handling, storage, supervision, administration, and all other items necessary for the satisfactory completion of the Work, whether or not expressly specified or indicated, incidental work and unexpected expenses, and all terms, conditions, requirements and limitations set forth in the Contract Documents.
2. Contract Sum may be expressed as lump sum, unit price, GMP, allowance, or combination thereof.

B. Unit Price items

1. Quantity of Work to be paid for under any item for which a unit price is fixed in Contract Documents shall be determined by City based on, so far as practicable, actual number of units satisfactorily completed, as determined by City and certified by Contractor, within prescribed or ordered limits, and no payment will be made for Work unsatisfactorily performed or done outside of limits.
2. Unit Prices shall apply to Work covered by unit prices so long as actual quantities performed on the Project are not less than 75 percent or greater than 125 percent of the estimated quantities bid or otherwise stated in the Contract Documents. If actual quantities exceed these parameters, then the unit price shall be adjusted by an amount to reflect the Contractor's incremental cost differential resulting from increased or decreased economies of scale.

C. Lump Sum Items

1. When estimated quantity for specific portion of Work is not indicated and/or Work is designated as lump sum, payment will be on a lump sum basis for Work satisfactorily completed in accordance with Contract Documents.
2. Payment for lump sum Work, or items of Work subject to a lump sum (e.g. without limitation, change order work), shall be made on the basis of satisfactory completion of such Work or work item, earned in progressive stages in accordance with the Contract Documents, up to but not exceeding the Contractor's percentage completion of the Work or item.
3. Lump sum items shall be paid based upon the approved Schedule of Values, which shall be

used to measure progressive payments based upon satisfactory progress towards completion of the item.

D. Allowance Items

1. Allowances: Allowance Work will be authorized by City in writing, following change order procedures to determine cost, supporting documentation and authorization to proceed. Unused allowance amounts at Contract completion shall reduce the Contract price accordingly.

3.04 PAYMENT PROCEDURES

A. Schedule of Values:

1. Within ten calendar days from issuance of Notice of Award and prior to the Contractor's first Application for Payment, Contractor shall submit a detailed breakdown of its Bid by scheduled Work items and/or activities, including coordination responsibilities and Project Record Documents responsibilities. Where more than one Subcontractor comprises the work of a Work item or activity, the Schedule of Values shall show a separate line item for each subcontract. Contractor shall furnish such breakdown of the total Contract Sum by assigning dollar values (cost estimates) to each applicable Progress Schedule network activity, which cumulative sum equals the total Contract Sum. This breakdown shall be referred to as the Schedule of Values.
2. Contractor's overhead, profit, insurance, cost of bonds (except to the extent expressly identified in a Bid item) and/or other financing, as well as "general conditions costs," (e.g., Site cleanup and maintenance, temporary roads and access, off-Site access roads, temporary power and lighting, security, and the like), shall be prorated through all activities so that the sum of all the Schedule of Values line items equals Contractor's total Contract Sum, less any allowances designated by City. Scheduling, record documents and quality assurance control shall be separate line items.
3. City will review the breakdown in conjunction with the Progress Schedule to ensure that the dollar amounts of this Schedule of Values are, in fact, reasonable cost allocations for the Work items listed. Upon favorable review by City, City will accept this Schedule of Values for use. City shall be the sole judge of fair market cost allocations.
4. City will reject any attempt to increase the cost of early activities, i.e., "front loading," resulting in a complete reallocation of moneys until such "front loading" is corrected. Repeated attempts at "front loading" may result in suspension or termination of the Work for default, or refusal to process progress payments until such time as the Schedule of Values is acceptable to City.

B. Contractor's Requests for Progress Payments

1. If requested by Contractor, progress payments will be made monthly, under the following conditions:
2. On or before the 25th Day of each month, Contractor shall submit to City five copies of an Application for Payment for the cost of the Work put in place during the period from the last Day of the previous month to the end of the current month, along with one copy of an updated Progress Schedule. Such Applications for Payment shall be for the expected total value of activities completed or partially completed, based upon Schedule of Values prices (or Bid item prices if unit price) of all labor and materials incorporated in the Work up until midnight of the last Day of that one month period, less the aggregate of previous payments. Accumulated retainage shall be shown as separate item in payment summary. City and Contractor will reconcile any differences in the field, based on the reconciled monthly report sheets. If Contractor is late submitting its Application for Payment, that Application may be processed at any time during the succeeding one-month period, resulting in processing of Contractor's Application for Payment being delayed for more than a Day for Day basis.
3. Except as otherwise provided in a labor compliance program applicable to the Work (if any) or as otherwise required by City, concurrently with each Application for Payment, Contractor shall submit to the City the Contractor's and its Subcontractors' certified payroll records required to be maintained pursuant to Labor Code Section 1776 for all labor performed during pay periods

ending during the period covered by the Application for Payment.

4. No progress payment will be processed prior to City receiving all requested, acceptable schedule update information and certified payrolls, and in City's sole and absolute discretion, City may deny the entire Application for Payment for noncompliance.
5. Each Application for Payment shall list each Change Order and Construction Change Directive ("CCD") executed prior to date of submission, including the Change Order/CCD Number, and a description of the Work activities, consistent with the descriptions of original Work activities. Contractor shall submit a monthly Change Order/CCD status log to City.
6. If City requires substantiating data, Contractor shall submit information requested by City, with cover letter identifying Project, Application for Payment number and date, and detailed list of enclosures. Contractor shall submit one copy of substantiating data and cover letter for each copy of Application for Payment submitted.
7. If Contractor fails or refuses to participate in monthly Work reconciliations or other construction progress evaluation with City, Contractor shall not receive current payment until Contractor has participated fully in providing construction progress information and schedule update information to City.

C. City's Review of Progress Payment Applications

1. City will review Contractor's Application for Payment following receipt and during the Progress Schedule and Billing Meeting. If adjustments need to be made to percent of completion of each activity, City will make appropriate notations and return to Contractor. Contractor shall revise and resubmit. All parties shall update percentage of completion values in the same manner, i.e., express value of an accumulated percentage of completion to date.
2. If City determines that portions of the Application for Payment are not proper or not due under the Contract Documents, then City may approve the other portions of the Application for Payment, and in the case of disputed items or Defective Work not remedied, may withhold up to 150 percent of the disputed amount from the progress payment.
3. Pursuant to California Public Contract Code §20104.50, if City fails to make any progress payment within 30 calendar days after receipt of an undisputed and properly submitted Application for Payment from Contractor, City shall pay interest to the Contractor equivalent to the legal rates set forth in subdivision (a) of Section 685.010 of the California Code of Civil Procedure. The 30-Day period shall be reduced by the number of calendar days by which City exceeds the seven-Day return requirement set forth herein.
4. As soon as practicable after approval of each Application for Payment for progress payments, City will pay to Contractor in manner provided by law, an amount equal to 95 percent of the amounts otherwise due as provided in the Contract Documents, or a lesser amount if so provided in Contract Documents and by law, provided that payments may at any time be withheld if, in judgment of City, Work is not proceeding in accordance with Contract, or Contractor is not complying with requirements of Contract, or to comply with stop notices or to offset liquidated damages accruing or expected. In City's sole discretion, if Contractor has failed to comply with either its Progress Schedule update or project record documents requirements, City may retain an additional 5% of any earned amounts until such requirements are satisfied.
5. Before any progress payment or final payment is due or made, Contractor shall submit satisfactory evidence that Contractor is not delinquent in payments to employees, Subcontractors, suppliers, or creditors for labor and materials incorporated into Work. This specifically includes, without limitation, conditional lien release forms for the current progress payment and unconditional release forms for past progress payments. This also includes copies of certified payroll from contractor and subcontractors for the current payment period.

D. Payment for Material and Equipment Not Yet Incorporated Into the Work

1. No payment shall be made for materials or equipment not yet incorporated into the Work,

except as specified elsewhere in the Contract Documents or as may be agreed to by City in its sole discretion. Where Contractor requests payment on the basis of materials and equipment not incorporated in the Work, Contractor must satisfy the following conditions:

2. The materials and/or equipment shall be delivered and suitably stored at the Site or at another local location agreed to in writing, for example, a mutually acceptable bonded and insured warehouse.
3. Full title to the materials and/or equipment shall vest in City at the time of delivery to the Site, warehouse or other storage location. Obtain a negotiable warehouse receipt, endorsed over to City for materials and/or equipment stored in an off-site warehouse. No payment will be made until such endorsed receipts are delivered to City.
4. Stockpiled materials and/or equipment shall be available for City inspection, but City shall have no obligation to inspect them and its inspection or failure to inspect shall not relieve Contractor of any obligations under the Contract Documents. Materials and/or equipment shall be segregated and labeled or tagged to identify these specific Contract Documents.
5. After delivery of materials and/or equipment, if any inherent or acquired defects are discovered, defective materials and/or equipment shall be removed and replaced with suitable materials and/or equipment at Contractor's expense.
6. At Contractor's expense, insure the materials and/or equipment against theft, fire, flood, vandalism, and malicious mischief, as well as any other coverages required under the Contract Documents.
7. Contractor's Application for Payment shall be accompanied by a bill of sale, invoice or other documentation warranting that City has received the materials and equipment free and clear of all liens and evidence that the materials and equipment are covered by appropriate property insurance and other arrangements to protect City interest therein, all of which must be satisfactory to City. This documentation shall include, but not be limited to, conditional releases of mechanics' liens and stop notices from all those providing materials and equipment as to which the Application for Payment relates, as well as unconditional releases of the same from the same as to the previous Application for Payment for which they have not already been provided. Amounts previously paid for materials and equipment prior to incorporation into the Work shall be deducted from amounts otherwise due Contractor as they are incorporated.

3.05 FINAL PAYMENT

A. Final Payment

1. As soon as practicable after all required Work is completed in accordance with Contract Documents, including punchlist, testing, record documents and Contractor maintenance after Final Acceptance, Contractor shall submit its Application for Final Payment.
2. Provided Contractor has met all conditions required for Final payment, City will pay to Contractor, in manner provided by law, unpaid balance of Contract Sum of Work (including, without limitation, retentions), or whole Contract Sum of Work if no progress payment has been made, determined in accordance with terms of Contract Documents, less sums as may be lawfully retained under any provisions of Contract Documents or by law.

B. Final Accounting

1. Prior progress payments and change orders shall be subject to audit and correction in the final payment.
2. Contractor and each assignee under an assignment in effect at time of final payment shall execute and deliver at time of final payment, and as a condition precedent to final payment, Document 00 6530 (Agreement and Release of Claims).

3.06 SUBSTITUTION OF SECURITIES

A. **Public Contract Code Section 22300.** In accordance with the provisions of Public Contract

Code Section 22300, substitution of securities for any moneys withheld under Contract Documents to ensure performance is permitted under following conditions:

1. At request and expense of Contractor, securities listed in Section 16430 of the Government Code, bank or savings and loan certificates of deposit, interest bearing demand deposit accounts, standby letters of credit, or any other security mutually agreed to by Contractor and City which are equivalent to the amount withheld under retention provisions of Contract shall be deposited with Controller or with a state or federally chartered bank in California, as the escrow agent, who shall then pay such moneys to Contractor. Upon satisfactory completion of Contract, securities shall be returned to Contractor.
2. Alternatively, Contractor may request and City shall make payment of retentions earned directly to the escrow agent at the expense of Contractor. At the expense of Contractor, Contractor may direct the investment of the payments into securities and receive the interest earned on the investments upon the same terms provided for securities deposited by Contractor. Upon satisfactory completion of the work of the Contract Documents, Contractor shall receive from escrow agent all securities, interest, and payments received by the escrow agent from City. Contractor shall then pay to each Subcontractor, not later than 10 calendar days after receipt of the payment, the respective amount of interest earned, net of costs attributed to retention withheld from each Subcontractor, on the amount of retention withheld to insure the performance of Contractor.
3. Contractor shall be beneficial owner of securities substituted for moneys withheld and shall receive any interest thereon.
4. Contractor may enter into an escrow agreement, form included in Contract Documents, as authorized under Public Contract Code Section 22300, specifying amount of securities to be deposited, terms and conditions of conversion to cash in case of default of Contractor, and termination of escrow upon completion of Contract Documents.
5. Public Contract Code Section 22300, in effect on Bid Day, is hereby incorporated in full by this reference and shall supersede anything inconsistent therewith.

PART 4 - PRODUCTS – NOT USED**PART 5 - EXECUTION – NOT USED****END OF SECTION**

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DIVISION 1 GENERAL REQUIREMENTS**SECTION 01 2600****MODIFICATION PROCEDURES****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes requirements that supplement the paragraphs of Document 00 7200 (General Conditions).
- B. Description of procedures for modifying the Contract Documents and determining costs for changes in contract amounts.

1.02 PROCEDURES FOR CONTRACTOR INITIATED CHANGE ORDER

- A. Contractor-Initiated Change Proposal Request (CPR) and Procedures:
 1. Contractor may initiate changes by submitting a Change Proposal Request ("CPR").
 2. Whenever Contractor elects or is entitled to submit a CPR, Contractor shall prepare and submit to City for consideration a CPR using the form included in this Project Manual. All CPRs must contain a complete breakdown of costs of credits, deducts and extras; itemizing materials, labor, taxes, Markup and any requested changes to Contract Time. All Subcontractor Work shall be so indicated. Individual entries on the CPR form shall include applicable Schedule of Values code, with all amounts determined as provided herein. After receipt of a CPR with a detailed breakdown, City will act promptly thereon.
 3. If City accepts a CPR, City will prepare a Change Order for City and Contractor signatures.
 4. If CPR is not acceptable to City because it does not agree with Contractor's proposed cost and/or time, City will provide comments thereto. Contractor will then, within seven (7) calendar days (except as otherwise provided herein), submit a revised CPR.
 5. When necessity to proceed with a change does not allow City sufficient time to conduct a proper check of a CPR (or revised CPR), City may issue a Change Directive (CD) as provided below.
- B. Contractor-Initiated Request for Information (RFI) Procedures, Requirements and Limitations:
 1. Contractor may submit RFI's for clarifications in City-prepared Contract Documents, which may result in the Contractor submitting a CPR.
 2. Whenever Contractor requires information regarding the Project or City-prepared Contract Documents, or receives a request for such information from a Subcontractor, Contractor may prepare and deliver an RFI to City. Contractor shall use RFI format provided on approval by City. Contractor shall not issue an RFI to City solely to clarify Contractor-prepared Construction Documents. Contractor must submit time critical RFIs at least 30 calendar days before scheduled start date of the affected Work activity. Contractor shall reference each RFI to an activity of Progress Schedule and shall note time criticality of the RFI, indicating time within which a response is required. Contractor's failure to reference RFI to an activity on the Progress Schedule and note time criticality on the RFI shall constitute Contractor's waiver of any claim for time delay or interruption to the Work resulting from any delay in responding to the RFI.
 3. Contractor shall be responsible for its costs to implement and administer RFIs throughout the Contract duration. Regardless of the number of RFIs submitted, Contractor shall not be entitled to additional compensation for the effort required to submit the RFIs. Contractor shall be

responsible for City's administrative costs for answering RFIs where the answer could reasonably be found by reviewing the Contract Documents, as determined by City; at City discretion, such costs may be deducted from progress payments or final payment.

4. City will respond within ten (10) calendar days from receipt of RFI with a written response to Contractor. Contractor shall distribute response to all appropriate Subcontractors.
5. If Contractor is satisfied with the response and does not request a change in Contract Sum or Contract Time, then the response shall be executed without a change.
6. If Contractor believes the response is incomplete, Contractor shall issue another RFI (with the same RFI number with the letter "A" indicating it is a follow-up RFI) to City clarifying original RFI. Additionally, City may return RFI requesting additional information should original RFI be inadequate in describing condition.

C. Time Requirements:

1. If Contractor believes that a City response to an RFI, submittal or other City direction, results in change in Contract Sum or Contract Time, Contractor shall notify City with the issuance of a preliminary CPR within ten calendar days after receiving City's response or direction, and in no event after starting the disputed work or later than the time allowed under Article 12 of Document 00 7200 (General Conditions). If Contractor also requests a time extension, or has issued a notice of delay or otherwise requests a time extension with a CPR, then Contractor shall submit a Time Impact Evaluation (TIE) required herein concurrently with the CPR and in no event later than ten calendar days after providing the notice of delay.
2. If Contractor requires more time to accurately identify the required changes to the Contract Sum or Contract Time, Contractor may submit an updated and final CPR and TIE within 14 calendar days of submitting the preliminary CPR.
3. If City agrees with Contractor's CPR and/or TIE, then City will prepare a Change Order for City and Contractor signatures. If City disagrees with Contractor, then Contractor may give notice of potential claim as provided in Article 12 of Document 00 7200 (General Conditions), and proceed thereunder.
4. Contractor must submit CPRs, notices of potential claim or Claims within the required time periods. Any failure to do so waives Contractor's right to submit a CPR or file a Claim.

D. Cost Estimate Information:

1. Contractor and subcontractors shall, upon City's request, permit inspection of the original unaltered cost estimates, subcontract agreements, purchase orders relating to the change, and documents substantiating all costs associated with its CPR or Claims arising from changes in the Work.

1.03 PROCEDURES FOR CITY INITIATED CHANGE ORDERS

A. City Initiated Change Directives (CD):

1. City may, by Change Directive ("CD") or initially by Instruction Bulletin or by following the procedures for disputed work herein, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, with or without adjustment to Contract Sum or Contract Time.
2. If at any time City believes in good faith that a timely Change Order will not be agreed upon using the foregoing procedures, or at any other time, City may issue a CD with its recommended cost and/or time adjustment (if any). Upon receipt of CD, Contractor shall promptly proceed with the change of Work involved and respond to City within ten (10) calendar days.
3. Contractor's response must be any one of following:
 - a. Return CD signed, thereby accepting City response, including adjustment to time and cost (if any).

- b. Submit a (revised if applicable) Cost Proposal with supporting documentation (if applicable, reference original Cost Proposal number followed by letter A, B, etc. for each revision), if City so requests.
 - c. Give notice of intent to submit a claim as described in Article 12 of Document 00 7200 (General Conditions), and submit its claim as provided therein.
4. If CPR or the CD provides for an adjustment to any Contract Sum, the adjustment shall be based on one of the following methods:
 - a. Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation.
 - b. Contractor to proceed on cost reimbursable (force account) basis while negotiating towards a firm price.
 - c. Cost to be determined in a manner agreed.
 5. Change Directive signed by Contractor indicates the agreement of Contractor therewith, including adjustment in Contract Sum or the method for determining them. Such agreement shall be effective immediately and shall be finalized as a Change Order. Where City authorizes CD work on a time and materials basis up to a maximum amount, then Contractor shall promptly advise City upon reaching 75% of such maximum amount, otherwise Contractor shall accept fully the risk of completing the CD work without exceeding such maximum amount.
 6. If Contractor does not respond promptly or disagrees with the method for adjustment (or non-adjustment) in the Contract Sum, the method and the adjustment shall be determined by City on the basis of the Contract Documents and the reasonable expenditures and savings of those performing the Work attributable to the change. If the parties still do not agree on the proper adjustment due to a Change Directive, Contractor may file a Claim per Article 12 of Document 00 7200 (General Conditions) and/or City may direct the changed work through a unilateral change order. Contractor shall keep and present an itemized accounting in a manner consistent with the SOV, together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this paragraph shall be limited to those provided herein.
 7. Pending final determination of cost to City, Contractor may include amounts not in dispute in its Applications for Payment. The amount of credit to be allowed by Contractor to City for a deletion or change which results in a net decrease in the Contract Sum shall be actual net cost as confirmed by City. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for Markup shall be figured on the basis of net increase, if any, with respect to that change.
- B. City Initiated Change Order (CO) or Request for Proposal (RFP):
1. City may initiate changes in the Work or Contract Time by issuing a Request for Proposal ("RFP") or Change Order ("CO") to Contractor.
 2. City may issue an RFP to Contractor. Any RFP will detail all proposed changes in the Work and request a quotation of changes in Contract Sum and Contract Time from Contractor.
 3. In response to an RFP, Contractor shall furnish a Change Proposal Request (CPR) within twenty-one (21) Business Days of City's RFP. Upon approval of CPR, City may issue a Change Directive directing Contractor to proceed with extra Work.
 4. If the parties agree on price and time for the work, the City will issue a Contact Change Order. If the parties do not agree on the price or time for a CPR, City may either issue a CD or decide the issue per Article 12 of Document 00 7200 (General Conditions). Contractor shall perform the changed Work notwithstanding any claims or disagreements of any nature.

1.04 PROCEDURES THAT APPLY TO CONTRACTOR- AND CITY-INITIATED CHANGE ORDERS

A. Adjustment of Schedules to Reflect Change Orders or CDs:

1. Contractor shall revise Schedule of Values and Application for Payment forms to record each

authorized Change Order or CD as a separate line item and adjust the Contract Sum as shown thereon prior to the next monthly pay period.

2. Contractor shall revise the Progress Schedules prior to the next monthly pay period, to reflect CO or CD.
3. Contractor shall enter changes in Project Record Documents prior to the next monthly pay period.

B. Required Documentation for Adjustments to Contract Amounts:

1. For all changes and cost adjustments requested, Contractor shall provide documentation of change in Contract Amounts asserted, with sufficient data to allow evaluation of the proposal.
2. In all requests for compensation, cost proposals, estimates, claims and any other calculation of costs made under the Contract Documents, Contractor shall breakout and quantify costs of labor, equipment and materials identified herein, for Contractor and subcontractors of any tier.
3. Contractor shall, on request, provide additional data to support computations for:
 - a. Quantities of products, materials, labor and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Justification for any change in Contract Time and new Progress Schedule showing revision due, if any.
 - d. Credit for deletions from Contract, similarly documented.
4. Contractor shall support each claim or computation for additional cost, with additional information including:
 - a. Origin and date of claim or request for additional compensation.
 - b. Dates and times Work was performed and by whom.
 - c. Time records and wage rates paid.
 - d. Invoices and receipts for products, materials, equipment and subcontracts, similarly documented.
 - e. Credit for deletions from Contract, similarly documented.

C. Responses and Disputes:

1. For all responses for which the Contract Documents do not provide a specific time period, recipients shall respond within a reasonable time.
2. For all disputes arising from the procedures herein, Contractor shall follow Article 12 of Document 00 7200 (General Conditions).

1.05 COST DETERMINATION FOR CHANGES IN CONTRACT AMOUNTS

A. Calculation of Total Cost of Extra Work:

1. Total cost of changed Work, extra Work or of Work omitted shall be the sum of three components defined immediately below as: Component 1 (Direct Cost(s)); Component 2 (Markup); and, Component 3 (bonds, insurance, taxes)
2. Component 1: Direct Cost(s) of labor, equipment and materials, is calculated based upon actually incurred (or omitted) labor costs, material costs and equipment rental costs, as defined herein;
3. Component 2: Markup on such actually incurred Direct Costs, is applied in the percentages identified below; and
4. Component 3: Actual additional costs for any additionally required insurance, bonds, and/or taxes, defined herein, is calculated without Markup.

1.06 MEASUREMENT OF DIRECT COST OF CONSTRUCTION (COST COMPONENT NO. 1)

A. Composition of Component 1 (Direct Cost of Construction):

1. Component 1 has four subcomponents, also referred to as "LEMS":
 - a. Labor (Component 1A)
 - b. Equipment (Component 1B)
 - c. Materials (Component 1C)
 - d. Subcontractors (Component 1D)
- B. Measurement of Cost of Labor (Component 1A):
 1. Cost of Labor shall be calculated as: Cost of labor for workers (including forepersons when authorized by City) used in actual and direct performance of the subject work, whether employer is Contractor, Subcontractor or other forces, in the sum of the following:
 - a. Actual Wages: Actual wages paid shall include any employer payments to or on behalf of workers for health and welfare, pension, vacation, and similar purposes.
 - b. Labor surcharge: Payments imposed by local, county, state, and federal laws and ordinances, and other payments made to, or on behalf of, workers, other than actual wages as defined, such as worker's compensation insurance. Such labor surcharge shall not exceed generally accepted standards in the State for labor rates in effect on date upon which extra Work is accomplished.
 - c. Cost of labor shall include no other costs, fees or charges.
 2. Labor cost for operators of equipment owned and operated by Contractor or any Subcontractor, shall be no more than rates of such labor established by collective bargaining agreements for type of worker and location of Work, whether or not owner-operator (i.e., Contractor or Subcontractor) is actually covered by such an agreement.
 3. Cost of labor shall be recorded and documented in certified payroll records, maintained in the form customary and/or required in the State, delivered to City weekly.
- C. Measurement of Cost of Equipment (Component 1B):
 1. Measurement of Component 1B (Cost of Equipment). Cost of Equipment shall be calculated as: Cost of Equipment used in actual and direct performance of the subject work, whether by Contractor, Subcontractor or other forces. Cost of Equipment shall be calculated as herein described.
 2. For rented equipment, cost will be based on actual rental invoices, appropriate for the use and duration of the work. Equipment used on extra Work shall be of proper size and type. If, however, equipment of unwarranted size or type and cost is used, cost of use of equipment shall be calculated at rental rate for equipment of proper size and type, as determined by City.
 3. Equipment rental cost for Contractor or Subcontractor-owned equipment, shall be determined by reference to, and not in excess of, the generally accepted standards in the State for equipment rental rates in effect on date upon which extra Work is accomplished. If there is no applicable rate for an item of equipment, then payment shall be made for Contractor- or Subcontractor-owned equipment at rental rate listed in the most recent edition of the CalTrans Standard Schedules and Specifications, and absent a rental rate therein, then the Association of Equipment Distributors (AED) book.
 4. In all cases, rental rates paid shall be deemed to cover cost of fuel, oil, lubrication, supplies, small tools, necessary attachments, repairs and maintenance of any kind, depreciation, storage, insurance, and all incidentals.
 5. Unless otherwise specified, manufacturer's ratings, and manufacturer-approved modifications, shall be used to classify equipment for determination of applicable rental rates. Individual pieces of equipment or tools not listed in said publication and having a replacement value of \$100 or less, whether or not consumed by use, shall be considered to be small tools and no payment will be made therefore as payment is included in payment for labor. Rental time will not be allowed while equipment is inoperative due to breakdowns.
 6. For equipment on Site, rental time to be paid for equipment shall be time equipment is in

operation on extra Work being performed or on standby as approved by City. The following shall be used in computing rental time of equipment:

- a. When hourly rates are listed, less than 30 minutes of operation shall be considered to be $\frac{1}{2}$ hour of operation.
 - b. When daily rates are listed, less than four hours of operation shall be considered to be $\frac{1}{2}$ Day of operation.
 - c. Rates shall correspond to actual rates paid by Contractor, i.e., if Contractor pays lower weekly or monthly rates, then same shall be charged to City.
7. For equipment that must be brought to Site to be used exclusively on extra Work, cost of transporting equipment to Site and its return to its original location shall be determined as follows:
- a. City will pay for costs of loading and unloading equipment.
 - b. Cost of transporting equipment in low bed trailers shall not exceed hourly rates charged by established haulers.
 - c. Cost of transporting equipment shall not exceed applicable minimum established rates of California Public Utilities Commission or appropriate State Dept. of Transportation.
 - d. City will not make any payment for transporting and loading and unloading equipment if equipment is used on Work in any other way than upon extra Work.
 - e. Rental period may begin at time equipment is unloaded at Site of extra Work and terminate at end of the performance of the extra Work or Day on which City directs Contractor to discontinue use of equipment, whichever first occurs. Excluding Saturdays, Sundays, and City legal holidays, unless equipment is used to perform extra Work on such Days, rental time to be paid per Day shall be four hours for zero hours of operation, six hours for four hours of operation and eight hours for eight hours of operation, time being prorated between these parameters. Hours to be paid for equipment that is operated less than eight hours due to breakdowns, shall not exceed eight less number of hours equipment is inoperative due to breakdowns.
8. Employee vehicles are not part of Component 1A, rather, are included within Component 2 (Markup).
9. Equipment costs shall include no other costs, fees or charges.
- D. Measurement of Cost of Material (Component 1C):
1. Cost of Material shall be calculated as herein described. Cost of such materials will be cost to purchaser (Contractor, Subcontractor or other forces) from supplier thereof, except as the following are applicable:
 2. If cash or trade discount by actual supplier is offered or available to purchaser, it shall be credited to City notwithstanding fact that such discount may not have been taken.
 3. For materials salvaged upon completion of Work, salvage value of materials shall be deducted from cost, less discounts, of materials.
 4. If cost of a material is, in opinion of City, excessive, then cost of material shall be deemed to be lowest current wholesale price at which material is available in quantities concerned delivered to Site, less any discounts as provided in this Paragraph.
 5. Material costs shall include no other costs, fees or charges.

E. Measurement of Cost of Subcontractors (Component 1D):

1. Where reimbursed or calculated per the terms of the Contract Documents, change order or Change Directive, cost of Subcontractors shall be calculated as amounts earned by Subcontractors procured in compliance with the Contract Documents and approved by the City, provided such subcontractor earned amounts meet the following requirements:
 - a. Such amounts are earned under the terms of the Subcontracts and the Work complies with the terms of the Contract Documents;

- b. Such amounts are properly requested, documented and permitted under the terms of the subcontract(s) and the Contract Documents.
- c. Total cost to City of Direct Costs of Construction (labor, equipment, materials), Markup, and costs of bonds, insurance and taxes, conform to contract limitations (i.e., totals paid by City do not exceed the 20% Markup limitation.).

1.07 MEASUREMENT AND PAYMENT OF MARK UP (COST COMPONENT 2)

A. Markup Percentages for Changed Work (Component 2):

1. Markup on Direct Cost of labor and materials for extra Work shall be 15%. Markup on Direct Cost of equipment for extra Work shall be 15%.
2. When extra Work is performed by Subcontractors, regardless of the number of tiers, total Markup on "Component 1" Direct Costs shall not exceed 20%. Contractor and its Subcontractors shall divide the 20% as they may agree.
3. Under no circumstances shall the total Markup on any extra Work exceed twenty (20) percent, stated as a percent of the Direct Cost of labor, equipment and materials. This limitation shall apply regardless of the actual number of subcontract tiers.
4. On proposals covering both increases and decreases in Contract Sum, Markup shall be allowed on the net increase only as determined above. When the net difference is a deletion, no percentage for Markup shall be allowed, but rather an appropriate percentage deduction shall be issued in the amount of the net difference.

B. Measurement and Payment of Mark Up (Component 2):

1. Mark Up (Component 2) provides complete compensation to Contractor for:
 - a. All Contractor profit;
 - b. All Contractor home-office overhead;
 - c. All Contractor assumption of risk assigned to Contractor under the Contract Documents;
 - d. Subject to the qualifications below regarding self-performed work, all General Conditions and General Requirements.
2. Profit. Compensation for profit included within Component 2 (Mark Up), includes without limitation: Fees of all types, nature and description; and Profit and margins of all types, nature and description.
3. Home Office Expenses. Compensation for home office expenses included within Component 2 (Mark Up), includes without limitation: Salaries and other compensation of any type of Contractor's personnel (management, administrative and clerical), and all direct and indirect operating, travel, payroll, safety, storage, quality control, maintenance and overhead costs of any nature whatsoever, incurred by Contractor at any location other than the Project specific site office, including without limitation, Contractor's principal or branch offices; insurance premiums other than those for Project specific insurance directed by the City in a change order; all hardware, software, supplies and support personnel necessary or convenient for Contractor's capture, documentation and maintenance of its costs and cost accounting data and cost accounting and control systems and work progress reporting.
4. Assumption of Risk. Compensation for Contractor's assumption of risk under the Contract Documents, included within Component 2 (Mark Up), includes without limitation loss, cost, damage, expense or liability resulting directly or indirectly from any of the following causes ("unallowable costs"), for Contractor and subcontractors of any tier: noncompliance with the Contract Documents, fault or negligence, defective or non-conforming Work, by Contractor or any Subcontractor or Vendor of any tier or anyone directly or indirectly employed by any of them, or for whose acts or omissions any of them are responsible or liable at law or under the Contract Documents; cost overruns of any type; costs in excess of any lump sum, not to exceed amount or GMP; costs resulting from bid or "buy out" errors, unallocated scope, or incomplete transfer of scope or contract terms to subcontractors; any costs incurred by Contractor relating to a Change in the Work without a Change Order or Change Directive in accordance with the

Contract Documents; costs for work or materials for which no price is fixed in the Contract Documents, unless it is expressly specified that such work or material is to be paid for as extra work.

5. General Conditions and Division 1 General Requirements. Compensation for Contractor's General Conditions and General Requirements Costs included within Component 2 (Mark Up), includes compensation to Contractor for: Contractor's direct costs, without overhead or profit, for salaries and related forms of compensation and employer's costs for labor and personnel costs, of Contractor's employees and subconsultant's employees (if any), while and only to the extent they are performing Work at the Project Site. Personnel and Work compensated by this Component include without limitation: All required Project management responsibilities; all on-site services; monthly reporting and scheduling; routine field inspection of Work; general superintendence; general administration and preparation of cost proposals, schedule analysis, change orders and other supporting documentation as necessary; salaries of project superintendent, project engineers, project managers, safety manager, other manager, timekeeper, and secretaries; all cost estimates and updates thereto; development, validation and updates to the project schedule; surveying; estimating. Compensation for Contractor's General Requirements Costs included within Component 2 (Mark Up), compensates Contractor for its "General Requirements" Costs, including without limitation: all scheduling hardware, software, licenses, equipment, materials and supplies; purchase, lease or rental, build out, procurement, supporting equipment and maintenance of temporary on-Site facilities, Project field and office trailers and other temporary facilities, office equipment and supporting utilities; platforms, fencing, cleanup and jobsite security; temporary roads, parking areas, temporary security or safety fencing and barricades, etc.; all Contractor's motor vehicles used by any Contractor's personnel, and all costs thereof; all health and safety requirements, required by law or City procedures; all surveying; all protection of Work; handling and disposal fees; final cleanup; repair or maintenance; other incidental Work; all items, activities and function similar to any of those described above; all travel, entertainment, lodging, board and the like.
6. Personnel compensated by the Markup Component do not include workers of foreman level or below in the case of self-performed work; rather, such personnel shall be treated as a Direct Cost of Construction. Costs compensated by the Markup component do not include temporary measures specifically required by the changed work, not otherwise required or ongoing in the prosecution of the Work, that commence specifically to support the changed work and conclude with the completion of the changed work. Such costs shall be treated as Direct Costs of Construction. Examples of General Requirements costs that this component may not cover are the following: temporary barricades or fencing of specific areas required specifically for the changed work; cranes required specifically for the changed work; extra security required specifically for the changed work.

1.08 MEASUREMENT AND PAYMENT OF BONDS INSURANCE TAXES (COMPONENT 3)

- A. Measurement of Bonds, Insurance, Taxes (Component 3):
 1. Component 3 (Bonds, Insurance, Taxes) consists of the cost of bonds, insurance and taxes, also referred to as "**BIT**". All State sales and use taxes, applicable County and applicable City sales taxes, shall be included. Federal and Excise tax shall not be included.
 2. There is no mark up on BIT.

1.09 EFFECT OF PAYMENT

- A. Change Order Compensation is All Inclusive.
 1. Except as provided expressly below regarding changes that extend the Contract Time, payment of calculated cost of extra work constitutes full and complete compensation for costs or expense arising from the extra Work, and is intended to be all inclusive.
 2. Payment for Direct Cost of Construction (Component 1 or LEMS) is intended to be all-inclusive. Any costs or risks not delineated within cost of labor, equipment or materials herein, shall be deemed to be within the costs and risks encompassed by the applicable Markups and

unallowable in any separate amount.

3. Payment of Markup (Component 2) is intended to be all-inclusive. Contractor waives claims for any further or different payment of cost and risk items delineated herein, other than the allowable percentage markup on costs set forth in the Contract Documents; such separate, further or different cost or risk items shall be unallowable, waived and liquidated within the allowable percentage markup.
4. Contractor shall recover no other costs or markups on extra work of any type, nature or description.

B. Exception for Changes Extending the Contract Time.

1. Where a change in the Work extends the Contract Time, Contractor may request and recover additional, actual direct costs, provided Contractor can demonstrate such additional costs are (i.) actually incurred performing the Work, (ii.) not compensated by the Markup allowed, and (iii) directly result from the extended Contract Time. Contractor shall make such request and provide such documentation following all required procedures, documentation and time requirements in the Contract Documents, and subject to all contract limitations of liability. Contractor may not seek or recover such costs using formulas (e.g., Eichleay).

C. Limits of Liability / Accord and Satisfaction.

1. The foregoing limits of compensation apply in all cases of claims for changed Work, whether calculating Change Proposal Requests, Change Orders or CDs, or calculating claims and/or damages of all types, and applies even in the event of fault, negligence, strict liability, or tort claims of all kinds, including strict liability or negligence. Contractor may recover no other costs arising out of or connected with the performance of extra Work, of any nature.
2. Under no circumstances may Contractor claim or recover special, incidental or consequential damages against City, its representatives or agents, whether arising from breach of contract, negligence, strict liability or other tort or legal theory, unless specifically and expressly authorized in the Contract Documents.
3. No change in Work shall be considered a waiver of any other condition of Contract Documents. No claim shall be made for anticipated profit, for loss of profit, for damages, or for extra payment whatever, except as expressly provided for in Contract Documents.
4. Accord and Satisfaction: Every Change Order and accepted CD 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. Contractor may elect to reserve its rights to disputed claims arising from or relating to the changed Work at the time it signs a Change Order or approves a CD, but must do so expressly in a writing delivered concurrently with the executed Change Order or approved CD, and must also submit a Claim for the reserved disputed items pursuant to Article 12 of Document 00 7200 (General Conditions) no later than thirty (30) calendar days after Contractor's first written notice of its intent to reserve rights. Execution of any Change Order or CD shall constitute Contractor's representation of its agreement with this provision.

1.10 MISCELLANEOUS REQUIREMENTS

A. City-Furnished Materials.

1. City reserves right to furnish materials as it deems advisable, and Contractor shall have no claims for costs and Markup on such materials.

B. Records And Certification.

1. All charges shall be recorded daily and summarized in Change Proposal Request form attached hereto. Contractor or authorized representative shall complete and sign form each day. Contractor shall also provide with the form: the names and classifications of workers and hours worked by each; an itemization of all materials used; and a list by size type and identification

number of equipment and hours operated.

2. City shall have the right to audit all records in possession of Contractor relating to activities covered by Contractor's claims for modification of Contract, including CD Work. This right shall be specifically enforceable, and any failure of Contractor to voluntarily comply shall be deemed an irrevocable waiver and release of all claims then pending that were or could have been subject to Article 12 of Document 00 7200 (General Conditions).

C.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

[COST PROPOSAL FORM FOLLOWS ON NEXT PAGE]

COST PROPOSAL (CP)

Owner Fire Warehouse Interior and Site Improvement Project
 Contract Number _____

CP Number: _____
 Date: _____
 In Response To _____
 RFP #, etc.

To: City of Berkeley
 Attention: Uriel Gonzalez
 1947 Center Street, 5th Floor
 Berkeley, CA 94704
 Phone: (510) 981-6400
 Fax: (510) 981-6390

From: [Insert Contractor's Name/Address]

This Cost Proposal is in response to the above-referenced _____ [insert RFP, etc. as applicable].
 Brief description of change(s): _____

ITEM DESCRIPTION	PRIME CONTRACTOR	SUB 1	SUB 2	SUB 3	SUB 4	TOTAL
MATERIAL						
LABOR						
EQUIPMENT						
Other (Specify) Extended Overhead						
TOTAL COST						
Subcontractor's Overhead & Profit 15 percent						
Contractor's Overhead & Profit 15 percent						
Overhead & Profit to Contractor for Subcontractor's Work 5 percent						
(percent of Total Cost above not including any Overhead & Profit – may not exceed 20%)						
GRAND TOTAL						
REQUESTED CHANGE IN CONTRACT TIME (CALENDAR DAYS)						
(Time Impact Evaluation Enclosed)						

By Contractor:

Signature:

Date:

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DIVISION 1 GENERAL REQUIREMENTS**SECTION 01 3119****PROJECT MEETINGS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Summary
 - 1. Section includes description of required project meetings.

1.02 PRECONSTRUCTION CONFERENCE

- A. Preconstruction Conference. City will call for and administer Preconstruction Conference at time and place to be announced (usually the week prior to start of Work at the Site). Contractor, all major Subcontractors, and major suppliers shall attend Preconstruction Conference. Agenda may include, but not be limited to, the following items:
 - 1. Schedules
 - 2. Personnel and vehicle permit procedures
 - 3. Use of premises
 - 4. Location of the Contractor's on-Site facilities & Temporary Utilities
 - 5. Security
 - 6. Housekeeping
 - 7. Submittal and RFI procedures
 - 8. Inspection and testing procedures, on-Site and off-Site
 - 9. Utility shutdown procedures
 - 10. Control and reference point survey procedures
 - 11. Injury and Illness Prevention Program
 - 12. Contractor's Initial Progress Schedule
 - 13. Contractor's Schedule of Values
 - 14. Contractor's Schedule of Submittals
 - 15. Jurisdictional agency requirements
 - 16. Project Communication Procedures
 - 17. Modification Procedures
 - 18. Site Access by City and Consultants
 - 19. As-Built/Record Documents
 - 20. Permits & Fees
 - 21. Coordination: (Work Performed for City under separate contract). (As Appropriate)
 - 22. City will distribute copies of minutes to attendees. Attendees shall have 7 calendar days to submit comments or additions to minutes. Minutes will constitute final memorialization of results of Preconstruction Conference.

1.03 WEEKLY PROJECT MEETINGS

- A. City will schedule and administer weekly progress meetings throughout duration of Work. Progress meetings will be held weekly unless otherwise directed by City. Meetings shall be held at City's Offices unless otherwise specified in Contract Documents.
 - 1. City's Representative will prepare agenda and distribute it 4 calendar days in advance of meeting to Contractor.
 - 2. Participants with agenda items shall present them.
 - 3. The Architect/Engineer and other responsible entities shall attend meetings unless otherwise

specified in Contract Documents or provided by City.

4. City shall record and distribute the meeting minutes. Minutes shall be distributed by the City to the Contractor within 3 business days after the meeting. Contractor shall distribute the minutes to those affected by decisions made at meeting. Attendees shall have five business days to submit comments or additions to the minutes. Minutes shall constitute final memorialization of results of meeting.
5. Progress meetings shall be attended by Contractor's job superintendent, major Subcontractors and suppliers, City, and others as appropriate to agenda topics for each meeting.
6. Agenda may contain the following items, as appropriate:
 - a. Review, revise as necessary, and approve previous meeting minutes
 - b. Review of Work progress since last meeting
 - c. Status of Construction Work Schedule, delivery schedules, adjustments
 - d. Submittal, RFI, and Change Order status
 - e. Review of the Contractor's safety program activities and results, including report on all serious injury and/or damage accidents
 - f. Other items affecting progress of Work

1.04 PROGRESS SCHEDULE AND BILLING MEETINGS

- A. A meeting will be held on approximately the 20th of each month to review the schedule update submittal and progress payment application.
- B. At this meeting, at a minimum, the following items will be reviewed:
 1. Percent complete of each activity;
 2. Time impact evaluations for Change Orders and Time Extension Request;
 3. Actual and anticipated activity sequence changes;
 4. Actual and anticipated duration changes; and
 5. Actual and anticipated Contractor delays.
 6. Waste Management Tracking/Tags
 7. As-Built/Record Documents
- C. These meetings are considered a critical component of overall monthly schedule update submittal and Contractor shall have appropriate personnel attend. At a minimum, Contractor's General Superintendent and Scheduler shall attend these meetings.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

DIVISION 1 GENERAL REQUIREMENTS

SECTION 01 3230

PROGRESS SCHEDULES AND SUBMITTALS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes description of requirements and procedures for submitting progress schedules and submittals.

1.02 CONTRACTOR TO SUBMIT PROGRESS SCHEDULES

- A. Contractor shall submit original (baseline) progress schedule two weeks prior to the first Application for Payment.
- B. Baseline Progress Schedule shall show Contractor's construction and procurement activities, including but not limited to, equipment procurement and delivery (Contractor and City supplied), activities with Subcontractors and suppliers, major submittal reviews, commissioning of systems, use of major equipment on site, and necessary interface with City and third parties required to complete the Work in a timely manner and in accordance with Contract Time.

1.03 SCHEDULE REQUIREMENTS.

- A. Unless City agrees in writing otherwise, progress schedule shall be on Microsoft Project, Primavera P6, Suretrack, or equivalent software, as City may specify, which Contractor shall prepare and supply to City, with all datapoint entries completed for start dates, necessary work activities, durations (not longer than 21 calendar days) and logic ties.
- B. Contractor's progress schedule may be in the form of a CPM (arrow) diagram or, if City agrees in writing, a bar chart or a Gantt chart. The hard copies of the schedule supplied to City shall indicate the critical path of the Work (in red) and shall show a logical progression of the Work through completion within Contract Time.
- C. Unless City agrees in writing otherwise, progress schedule shall also show early and late start and finish dates and total available float (float to the successor activity's late start date) for each activity. City has no obligation to accept an early completion schedule.

1.04 MONTHLY UPDATES

- A. Contractor's progress schedule shall be updated monthly to reflect actual progress. The schedule shall be subject to City's review and acceptance for use in monitoring Contractor's Work and evaluating Applications for Payment.
- B. Contractor shall supply City with an electronic copy of the updated progress schedule with each monthly payment application. Contractor shall provide City with three-week look ahead schedules weekly, showing in detail and activities and resources scheduled for the immediate two week period.

1.05 RECOVERY SCHEDULE

- A. City may request a recovery schedule should Contractor fall 21 or more calendar days behind any schedule Milestone, which schedule shall show Contractor's plan and resources committed to retain Contract completion dates.
- B. The recovery schedule shall show the intended critical path. If City requests, Contractor shall also:

Fire Warehouse Interior and Site Improvement Project
Specification No.24-11654-C

1. Secure and demonstrate appropriate Subcontractor and supplier consent to the recovery Schedule.
2. Submit a narrative explaining trade flow and construction flow changes and man-hour loading assumptions for major Work activities and/or Subcontractors.

1.06 TIME IMPACT EVALUATION (“TIE”) FOR CHANGE ORDERS, TIME EXTENSIONS AND DELAYS:

- A. When Contractor requests a time extension for any reason, Contractor shall submit a TIE that includes both a written narrative and a schedule diagram depicting how the changed Work or other impact affects other schedule activities. The schedule diagram shall show how Contractor proposes to incorporate the changed Work or other impact in the schedule and how it impacts the current Schedule update critical path or otherwise. Contractor is also responsible for requesting time extensions based on the TIE's impact on the critical path. The diagram shall be tied to the main sequence of scheduled activities to enable City to evaluate the impact of changed Work to the scheduled critical path.
- B. Contractor is responsible for all costs associated with the preparation of TIE's, and the process of incorporating TIE's into the current schedule update. Provide City with four copies of each TIE.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

DIVISION 1 GENERAL REQUIREMENTS**SECTION 01 3300****SUBMITTALS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes description of requirements and procedures for submittals.

1.02 SCHEDULE OF SUBMITTALS

- A. Contractor shall prepare for City's review and acceptance prior to commencement of work on the Site, for purposes of contract administration, a schedule of submittals (also referred to as a submittal register) required to complete the Work, prepared by Contractor and accepted by City for contract administration. Schedule of submittals shall include, for each submittal: the specification or drawing reference requiring the submittal, if applicable; the material, item, or process for which the submittal is required; the submittal number and identifying title of the submittal; the Contractor's anticipated submission date and the approval need date.
- B. Contractor shall update monthly the schedule of submittals to reflect actual submission and acceptance dates for submittals. Review by City of schedule of submittals does not excuse Contractor of obligation to supply, schedule and coordinate all submittals required by the Contract Documents.

1.03 CONTRACTOR TO SUBMIT SHOP DRAWINGS, PRODUCT DATA AND SUBMITTALS.

- A. Contractor shall review for compliance with Contract Documents, approve and submit to City Shop Drawings, Product Data, Samples and similar submittals required by Contract Documents.
- B. Contractor shall schedule and submit concurrently submittals covering component items forming a system or items that are interrelated. Contractor shall include certifications to be submitted with the pertinent drawings at the same time.
- C. Contractor shall coordinate scheduling, sequencing, preparing and processing of all submittals with performance of work so that work will not be delayed by submittal processing.
- D. Submittals shall specifically identify any Work depicted that does not conform to the Contract Documents.

1.04 CITY REVIEW OF SHOP DRAWINGS, PRODUCT DATA AND SUBMITTALS.

- A. After review by City of each Submittal, material will be returned to Contractor with actions defined as follows:
 1. NO EXCEPTIONS TAKEN - Accepted subject to its compatibility with general design concept of the Work, future Submittals and additional partial Submittals for any portions of the Work not covered in this Submittal. Does not constitute acceptance or deletion of specified or required items not shown on the Submittal.
 2. MAKE CORRECTIONS NOTED (NO RESUBMISSIONS REQUIRED) - Same as item 1 above, except that minor corrections as noted shall be made by Contractor.
 3. REVISE AS NOTED AND RESUBMIT - Rejected because of major inconsistencies or errors that shall be resolved or corrected by Contractor prior to subsequent review by City.
 4. REJECTED - RESUBMIT - Submitted material does not conform to Drawings and/or Specifications in major respect, i.e.: wrong size, model, capacity, or material.

- B. Favorable review will not constitute acceptance by City of any responsibility for the accuracy, coordination, or completeness of the Submittals. Accuracy, coordination, and completeness of Submittals shall be sole responsibility of Contractor, including responsibility to back-check comments, corrections, and modifications from City's review before fabrication. Contractor, Subcontractors, or suppliers may prepare Submittals, but Contractor shall ascertain that Submittals meet requirements of Contract Documents, while conforming to structural space and access conditions at point of installation. City's review will be only to assess if the items covered by the Submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as indicated by the Contract Documents. Favorable review of Submittal, method of Work, or information regarding materials and equipment Contractor proposes to furnish shall not relieve Contractor of responsibility for errors therein and shall not be regarded as assumption of risks or liability by City, or any officer or employee thereof, and Contractor shall have no claim under Contract Documents on account of failure or partial failure or inefficiency or insufficiency of any plan or method of Work or material and equipment so accepted. Favorable review shall be considered to mean merely that City has no objection to Contractor using, upon Contractor's own full responsibility, plan or method of Work proposed, or furnishing materials and equipment proposed.
- C. Unless otherwise specified, City's review will not extend to the means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
- D. Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been favorably reviewed by the City; otherwise, any such Work is at Contractor's sole risk.

PART 2 - PRODUCTS – NOT USED**PART 3 - EXECUTION – NOT USED****END OF SECTION**

DIVISION 1 GENERAL REQUIREMENTS**SECTION 01 4100****REGULATORY REQUIREMENTS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes:
 - 1. Regulatory requirements applicable to Contract Documents
 - 2. Required provisions under Local Agency Disputes Act
 - 3. Required references under federal law

1.02 GENERAL

- A. Compliance with Laws
 - 1. Conform to all applicable codes, laws, ordinances, rules and regulations, which shall have full force and effect as though printed in full in these Specifications. Codes, laws, ordinances, rules, regulations and ordinances (**Regulatory Requirements**) are not furnished to Contractor, because Contractor is assumed to be familiar with these requirements.
 - 2. Any listing of Regulatory Requirements for hazardous waste abatement Work in the Contract Documents is supplied to Contractor as a courtesy and shall not limit Contractor's responsibility for complying with all applicable Regulatory Requirements having application to the Work. Where conflict among the Regulatory Requirements or with these Specifications occurs, the most stringent requirements shall be used.
 - 3. Specific reference in the Specifications to codes and regulations or requirements of regulatory agencies shall mean the latest printed edition of each adopted by the regulatory agency in effect at the time of the opening of Bids, except as may be otherwise specifically stated in the Contract Documents.
- B. Precedence
 - 1. Where specified requirements differ from Regulatory Requirements, the more stringent requirements shall take precedence. Where Drawings or Specifications require or describe products or execution of better quality, higher standard or greater size than required by Regulatory Requirements, then Drawings and Specifications shall take precedence so long as such increase is legal. Where no requirements are identified on Drawings or in Specifications, comply with all Regulatory Requirements of governing authorities having jurisdiction.
 - 2. Should any conditions develop not covered by the Contract Documents wherein the finished Work will not comply with current codes, a Change Order detailing and specifying the required Work shall be submitted to and approved by City before proceeding with the Work.

1.03 REGULATORY REQUIREMENTS

- A. Applicable Codes
 - 1. Codes that apply to Contract Documents include all Codes applicable to construction, including, but not limited to, the following:
 - a. California Building Code (2016 Edition or latest applicable code) as amended by applicable local ordinances for all construction work.

- b. California Electrical Code (2016 Edition or latest applicable code) as amended by applicable local ordinances for all construction work.
- c. California Plumbing Code (2016 Edition or latest applicable code) as amended by applicable local ordinances for plumbing, sewage disposal and health requirements.
- d. California Mechanical Code (2016 Edition or latest applicable code) as amended by applicable local ordinances for all construction work.
- e. California Energy Code (2016 Edition or latest applicable code) as amended by applicable local ordinances for all construction work.
- f. California Green Building Standard Code (2016 Edition or latest applicable code) as amended by applicable local ordinances for all construction work.
- g. International Fire Code (2016 Edition or latest applicable code) as amended by applicable local ordinances for all construction work.
- h. California Administrative Code Titles 15, 19 and 24 (with California amendments), and Americans with Disabilities Act (ADA) accessibility guidelines, whichever is more stringent.
- i. All State laws and City and County Ordinances, rules of the State or City or County Health Departments, rules of the National Board of Fire Underwriters and National Fire Protection Associations, and local power company regulations for mechanical and electrical work.

B. Applicable Laws, Statutes, Ordinances, Rules, And Regulations

- 1. During prosecution of Work to be done under Contract Documents, Contractor shall comply with applicable laws, ordinances, rules and regulations, including, but not limited to, the following:
 - a. Federal:
 - 1) Americans With Disabilities Act of 1990
 - 2) 29 CFR, Section 1910.1001, Asbestos
 - 3) 40 CFR, Subpart M, National Emission Standards for Asbestos
 - 4) Executive Order 11246
 - 5) Federal Endangered Species Act
 - 6) Clean Water Act
 - b. State of California:
 - 1) California Code of Regulations, Titles 5, 8, 17, 19, 21, 22, 24 and 25
 - 2) California Public Contract Code
 - 3) California Health and Safety Code
 - 4) California Government Code
 - 5) California Labor Code
 - 6) California Civil Code
 - 7) California Code of Civil Procedure
 - 8) CPUC General Order 95, Rules for Overhead Electric Line Construction
 - 9) CPUC General Order 128, Rules for Construction of Underground Electric Supply and Communications Systems
 - 10) Cal/OSHA
 - 11) OSHA: Hazard Communications Standards
 - 12) California Endangered Species Act
 - 13) Water Code
 - 14) Fish and Game Code
 - c. State of California Agencies:
 - 1) State and Consumer Services Agency
 - 2) Office of the State Fire Marshall
 - 3) Office of Statewide Health Planning and Development
 - 4) Department of Fish and Game
 - 5) All Air Quality Management Districts with jurisdiction
 - 6) All Regional Water Quality Control Boards with jurisdiction
 - 7) Division of the State Architect (if having jurisdiction)
 - d. All Local Agencies with jurisdiction (cities, counties, fire departments)

C. Change Orders and Claims:

1. The California Public Contract Code, including but not limited to Section 7105(d)(2), and the California Government Code Section 930.2 et seq., apply to all contract procedures for changes, time extensions, change orders (time or compensation) and claims. Federal law (U.S. v. Holpuch 326 U.S. 234) shall supplement California law on the enforceability of these requirements.
2. Any change, waiver, or omission to implement contract change order and claim procedures shall have no legal effect unless expressly permitted in a fully executed change order approved by Contractor and City and approved as to form by their respective legal counsel.

D. Required Provisions On Contract Claim Resolution

1. The California Public Contract Code specifies required provisions on resolving contract claims less than \$375,000, which are set forth below, and constitute a part of this Contract.
2. For the purposes of this section, "Claim" means a separate demand by Contractor of \$375,000 or less for (1) a time extension, (2) payment or money or damages arising from Work done by or on behalf of Contractor arising under the Contract Documents and payment of which is not otherwise expressly provided for or the Claimant is not otherwise entitled to, or (3) an amount the payment of which is disputed by City. In order to qualify as a Claim, the written demand must state that it is a Claim submitted under paragraph 12 of Document 00 7200 (General Conditions) and be submitted in compliance with all requirements of Document 00 7200 (General Conditions), paragraph 12. Separate Claims which total more than \$375,000 do not qualify as a "separate demand of \$375,000 or less," as referenced above, and are not subject to this section.
3. A voucher, invoice, payment application, or other routine or authorized form of request for payment is not a Claim for purposes of this section. If such request is disputed as to liability or amount, then the disputed portion of the submission may be converted to a Claim under this section by submitting a separate claim in compliance with Contract Documents claim submission requirements.
4. Caution. This section does not apply to tort claims and nothing in this section is intended nor shall be construed to change the time periods for filing tort claims or actions specified by Chapter 1 and Chapter 2 of Part 3 of Division 3.6 of Title 1 of the California Government Code.

5. Procedure:

- a. The Claim must be in writing, submitted in compliance with all requirements of Document 00 7200 (General Conditions), paragraph 12, including, but not limited to, the time prescribed by and including the documents necessary to substantiate the Claim, pursuant to Document 00 7200 (General Conditions), paragraph 12.3. Claims must be filed on or before the day of final payment. Nothing in this section is intended to extend the time limit or supersede notice requirements for the filing of claims as set forth in Document 00 7200 (General Conditions), paragraph 12 or elsewhere in the Contract Documents.
- b. For Claims of fifty thousand dollars (\$50,000) or less, City shall respond in writing within forty-five (45) calendar days of receipt of the Claim, or City may request in writing within thirty (30) calendar days of receipt of the Claim, any additional documentation supporting the Claim or relating to any defenses or claims City may have against Claimant. If additional information is thereafter required, it shall be requested and provided in accordance with this section upon mutual agreement of City and Claimant. City's written response to the Claim, as further documented, shall be submitted to Claimant within fifteen (15) calendar days after receipt of further documentation or within a period of time no greater than taken by Claimant in producing the additional information, whichever is greater.
- c. For Claims over Fifty Thousand Dollars (\$50,000) and less than or equal to \$375,000: City shall respond in writing within sixty (60) calendar days of receipt of the Claim, or City may request in writing within thirty (30) calendar days of receipt of the Claim, any additional documentation supporting the Claim or relating to any defenses or claims City may have against Claimant. If additional information is thereafter required, it shall be requested and provided in accordance with this section, upon mutual agreement of City and Claimant;

City's written response to the Claim, as further documented, shall be submitted to Claimant within thirty (30) calendar days after receipt of further documentation or within a period of time no greater than taken by Claimant in producing the additional information, whichever is greater.

- d. Meet and Confer: If Claimant disputes City's written response, or City fails to respond within the time prescribed above, Claimant shall notify City, in writing, either within fifteen (15) calendar days of receipt of City's response or within fifteen (15) calendar days of City's failure to timely respond, and demand an informal conference to meet and confer for settlement of the issues in dispute. Upon demand City will schedule a meet and confer conference within thirty (30) calendar days for settlement of the dispute.
- e. Following the meet and confer conference, if the Claim or any portion remains in dispute, Claimant may file a claim 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 the California Government Code. For purposes of those provisions, the running of the period of time within which a claim must be filed shall be tolled from the time Claimant submits its written claim as set forth herein, 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.

E. Compliance With Americans With Disabilities Act

1. Contractor acknowledges that, pursuant to the Americans with Disabilities Act (ADA), programs, services and other activities provided by a public entity to the public, whether directly or through a Contractor, must be accessible to the disabled public. Contractor shall provide the services specified in the Contract Documents in a manner that complies with the ADA and any and all other applicable federal, state and local disability rights legislation. Contractor agrees not to discriminate against disabled persons in the provision of services, benefits or activities provided under the Contract Documents and further agrees that any violation of this prohibition on the part of Contractor, its employees, agents or assigns shall constitute a material breach of the Contract Documents.

F. Compliance With IRCA

1. Contractor acknowledges that Contractor, and all subcontractors hired by Contractor to perform services under this Agreement, are aware of and understand the immigration Reform and Control Act ("IRCA"). Contractor is and shall remain in compliance with the IRCA and shall ensure that any subcontractors hired by Contractor to perform services under this Agreement are in compliance with the IRCA. In addition, Contractor agrees to indemnify, defend and hold harmless City, its agents, officers and employees, from any liability, damages or causes of action arising out of or relating to any claims that Contractor's employees, or employees of any subcontractor hired by Contractor, are not authorized to work in the United States for Contractor or its subcontractor and/or any other claims based upon alleged IRCA violations committed by Contractor or Contractor's subcontractors.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

DIVISION 1 GENERAL REQUIREMENTS**SECTION 01 4200****REFERENCES AND DEFINITIONS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Reference standards, abbreviations, symbols, and definitions used in Contract Documents.
 - 2. Full titles are given in this Section for standards cited in other Sections of Specifications.

1.02 REFERENCE TO STANDARDS AND SPECIFICATIONS OF TECHNICAL SOCIETIES; REPORTING AND RESOLVING DISCREPANCIES

- A. References

- 1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard, specification, manual, code, or laws or regulations in effect at the time of opening of Bids, except as may be otherwise specifically stated in the Contract Documents.
 - 2. If during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any such law or regulation applicable to the performance of the Work or of any such standard, specification, manual, or code or of any instruction of any supplier, Contractor shall report it in writing at once to City's Representative and Architect/Engineer, and Contractor shall not proceed with the Work affected thereby until consent to do so is given by City.

- B. Precedence

- 1. Except as otherwise specifically stated in the Contract Documents or as may be provided by Change Order, CCD, or Supplemental Instruction, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:
 - a. The provisions of any such standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); or
 - b. The provisions of any such laws or regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such law or regulation).
 - 2. No provision of any such standard, specification, manual, code, or instruction shall be effective to change the duties and responsibilities of City, City's Representative, Architect/Engineer or Contractor, or any of their subcontractors, consultants, agents, or employees, from those set forth in the Contract Documents, nor shall it be effective to assign to City, Architect/Engineer, or any of their consultants, agents, representatives or employees any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

- C. Referenced Grades, Classes, and Types:

- 1. Where an alternative or optional grade, class, or type of product or execution is included in a reference but is not identified in Drawings or in Specifications, provide the highest, best, and

greatest of the alternatives or options for the intended use and prevailing conditions.

D. Edition Date of References:

1. When an edition or effective date of a reference is not given, it shall be understood to be the current edition or latest revision published as of the date of opening Bids.
2. All amendments, changes, errata and supplements as of the effective date shall be included.

E. **ASTM and ANSI References:** Specifications and Standards of the American Society for Testing and Materials (ASTM) and the American National Standards Institute (ANSI) are identified in the Drawings and Specifications by abbreviation and number only and may not be further identified by title, date, revision, or amendment. It is presumed that Contractor is familiar with and has access to these nationally- and industry-recognized specifications and standards.

1.03 DEFINITIONS

A. Meaning of Words and Phrases

Wherever any of the words or phrases defined below, or a pronoun used in place thereof, is used in any part of the Contract Documents, it shall have the meaning here set forth. Where abbreviations and symbols are used, such abbreviations and symbols shall be given their common meaning in the construction industry. In the Contract Documents, the neuter gender includes the feminine and masculine, and the singular number includes the plural.

While City has made an effort to identify all defined terms with initial caps, the following definitions shall apply regardless of case unless the context otherwise requires:

1. **Addenda:** Written or graphic instruments issued prior to the opening of Bids, which clarify, correct, or change the bidding requirements or the Contract Documents. Addenda shall not include the minutes of the Pre-Bid Conference and/or Site Visit.
2. **Agreement (Document 00 5200):** Agreement is the basic Contract Document that binds the parties to construction Work. Agreement defines relationships and obligations between City and Contractor and by reference incorporates Conditions of Contract, Drawings, and Specifications and contains Addenda and all Modifications subsequent to execution of Contract Documents.
3. **Alternate:** Work added to or deducted from the base Bid, if accepted by City.
4. **Application for Payment:** Written application for monthly or periodic progress or final payment made by Contractor complying with the Contract Documents.
5. **Approved Equal:** Approved in writing by City as being of equivalent quality, utility and appearance.
6. **Architect/Engineer:** If used elsewhere in the Contract Documents, "Architect/Engineer" shall mean a person (or that person's firm) holding a valid California State Architect's or Engineer's license representing the City in the administration of the Contract Documents. Architect/Engineer may be an employee of or an independent consultant to City. When Architect/Engineer is referred to within the Contract Documents and not an employee of City, Architect/Engineer shall be construed to include employees of Architect/Engineer and/or employees that Architect/Engineer supervises. When the designated Architect/Engineer is an employee of City, his or her authorized representatives on the Project will be included under the term Architect/Engineer. If Architect/Engineer is an employee of City, Architect/Engineer is the beneficiary of all Contractor obligations to City, including without limitation, all releases and indemnities. Architect/Engineer may also be referred to as Architect or Engineer.
7. **Asbestos:** Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by OSHA or Cal/OSHA.

8. **Bid**: The offer or proposal of the Bidder submitted on the prescribed form(s) setting forth the prices for the Work to be performed.
9. **Bidder**: One who submits a Bid.
10. **Bidding Documents**: All documents comprising the Project Manual (including all documents and Specification Sections listed in Document 00 0110 [Table of Contents]), including documents supplied for bidding purposes only and Contract Documents.
11. **Board**: The governing body of the City.
12. **Business Day**: Any Day other than Saturday, Sunday, and the following days that have been designated as holidays by City. If a holiday falls on a Saturday, the preceding Friday will be the holiday. If a holiday falls on a Sunday, the following Monday will be the holiday.
 - a. New Year's Day, January 1;
 - b. Martin Luther King Jr.'s Birthday, third Monday in January;
 - c. Lincoln's Birthday, February 12;
 - d. Presidents' Day, third Monday in February;
 - e. Malcolm X Day, third Friday in May;
 - f. Memorial Day, last Monday in May;
 - g. Juneteenth, June 19;
 - h. Independence Day, July 4;
 - i. Labor Day, first Monday in September;
 - j. Indigenous People's Day, second Monday in October;
 - k. Veterans' Day, November 11;
 - l. Thanksgiving Day, as designated by the President;
 - m. The Day following Thanksgiving Day;
 - n. Christmas Day, December 25; and
 - o. Each day appointed by the Governor of California and formally recognized by the Governing Board as a day of mourning, thanksgiving, or special observance.
13. **By City**: Work that will be performed by City or its agents at the City's expense.
14. **By Others**: Work that is outside scope of Work to be performed by Contractor under this Contract, which will be performed by City, other contractors, or other means.
15. **Change Order**: A written instrument prepared by City and signed by City and Contractor, stating their agreement upon all of the following:
 - a. a change in the Work;
 - b. the amount of the adjustment in the Contract Sum, if any; and
 - c. the amount of the adjustment in the Contract Time, if any.
16. **Change Proposal Request (CPR)**: A document prepared by Contractor requesting or initiating a request for modifying the Contract Documents and determining costs for changes in contract amount and any requested changes to Contract Time.
17. **City**: City is defined in Document 00 5200 (Agreement).
18. **City-Furnished, Contractor Installed**: Items furnished by City at its cost for installation by Contractor at its cost under Contract Documents.
19. **City's Representative(s)**: See Document 00 5200 (Agreement).
20. **Code Inspector**: A local or state agency responsible for the enforcement of applicable codes and regulations.
21. **Concealed**: Work not exposed to view in the finished Work, including within or behind various construction elements.
22. **Construction Change Directive ("CCD")**: A written order prepared and signed by City, directing a change in the Work and stating a proposed basis for adjustment, if any, in the Contract Sum or Contract Time, or both.

23. Contract Amount: a change order price, line item price, Contract Sum, or other price assigned to a scope of work.
24. Contract Conditions or Conditions of the Contract: Consists of two parts: General Conditions and Supplementary Conditions.
 - a. General Conditions are general clauses that are common to the City Contracts, including Document 00 7200 (General Conditions).
 - b. Supplementary Conditions modify or supplement General Conditions to meet specific requirements for Contract Documents, including Document 00 7201 (Supplementary Conditions).
25. Contract Documents and Contract: Contract Documents and Contract shall consist of the documents identified as the Contract Documents in Document 00 5200 (Agreement), plus all changes, Addenda, and modifications thereto.
26. Contract Modification: Either:
 - a. a written amendment to Contract signed by Contractor and City; or
 - b. a Change Order; or
 - c. a Construction Change Directive; or
 - d. a written directive for a minor change in the Work issued by City.
27. Contract Sum: The sum stated in the Agreement and, including authorized adjustments, the total amount payable by City to Contractor for performance of the Work and the Contract Documents. The Contract Sum is also sometimes referred to as the Contract Price or the Contract Amount.
28. Contract Time: The number or numbers of calendar days or the dates stated in the Agreement to achieve Substantial Completion of the Work or designated Milestones; and/or to achieve Final Completion of the Work so that it is ready for final payment and is accepted.
29. Contractor: The person or entity identified as such in the Agreement and referred to throughout the Contract Documents as if singular in number and neutral in gender. The term "Contractor" means the Contractor or its authorized representative.
30. Contractor's Employees: Persons engaged in execution of Work under Contract as direct employees of Contractor, as Subcontractors, or as employees of Subcontractors.
31. Day: One calendar day of 24 hours measured from midnight to the next midnight, unless the word "day" is specifically modified to the contrary.
32. Defective: An adjective which, when modifying the word "Work," refers to Work that is unsatisfactory or unsuited for the use intended, faulty, or deficient, that does not conform to the Contract Documents, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents (including but not limited to approval of Samples and "or equal" items), or has been damaged prior to final payment (unless responsibility for the protection thereof has been assumed by City). Unapproved substitutions are defective. City is the judge of whether Work is Defective.
33. Division of State Architect: A division of the State of California providing, design and construction oversight for K-12 schools and community colleges, and developing and maintaining accessibility standards and codes utilized in public and private buildings throughout the State of California.
34. Drawings: The graphic and pictorial portions of Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.
35. Equal: Equal in opinion of City. Burden of proof of equality is responsibility of Contractor.
36. Final Acceptance or Final Completion: City's acceptance of the Work as satisfactorily completed in accordance with Contract Documents. Requirements for Final Acceptance/Final

Completion include, but are not limited to:

- a. Final cleaning is completed.
 - b. All systems having been tested and accepted as having met requirements of Contract Documents.
 - c. All required instructions and training sessions having been given by Contractor.
 - d. All Project Record Documents having been submitted by Contractor, reviewed by City, and accepted by City.
 - e. All punch list Work, as directed by City, having been completed by Contractor.
 - f. Generally all Work, except Contractor maintenance after Final Acceptance/Final Completion, having been completed to satisfaction of City.
37. Force Account: Work directed to be performed without prior agreement as to lump sum or unit price cost thereof, and which is to be billed at cost for labor, materials, equipment, taxes, and other costs, plus a specified percentage for overhead and profit.
38. Exposed: Work exposed to view in the finished Work, including behind louvers, grilles, registers and various other construction elements.
39. Furnish: Supply Indicated: Shown or noted on the Drawings.
40. Indicated: Shown or noted on the Drawings.
41. Install: Install or apply only, do not furnish.
42. Latent: Not apparent by reasonable inspection, including but not limited to, the inspections and research required as a condition to bidding under Document 00 7200 (General Conditions).
43. Law: Unless otherwise limited, all applicable laws including without limitation all federal, state, and local laws, statutes, standards, rules, regulations, ordinances, and judicial and administrative decisions.
44. Material: This word shall be construed to embrace machinery, manufactured articles, materials of construction (fabricated or otherwise), and any other classes of material to be furnished in connection with Contract, except where a more limited meaning is indicated by context.
45. Milestone: A principal event specified in Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all Work.
46. Modification: Same as Contract Modification.
47. Not in Contract or "NIC": Work that is outside the scope of Work to be performed by Contractor under Contract Documents.
48. Notice of Completion: Shall have the meaning provided in California Civil Code §3093, and any successor statute.
49. Off Site: Outside geographical location of the Project.
50. Owner: Owner is the City of Berkeley, see Document 00 5200 (Agreement).
51. Partial Utilization: Use by City of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all of the Work.
52. PCBs: Polychlorinated biphenyls.
53. Phase: A specified portion of the Work (if any) specifically identified as a Phase in Document 00 5200 (Agreement) or Document 01 1100 (Summary).
54. Product Data: That information (brochures, catalog sheets, manufacturer's cut sheets, etc.) supplied by vendors having technical and commercial characteristics of the supplied equipment or materials and accompanying commercial terms such as warranties, instructions, and manuals.
55. Progress Report: A periodic report submitted by Contractor to City with progress payment

- invoices accompanying progress schedule. See Document 00 7200 (General Conditions).
56. Project: Total construction of which Work performed under Contract Documents may be whole or part.
 57. Project Manager: If used elsewhere in the Contract Documents, "Project Manager" shall mean a person representing the City in the administration of the Contract Documents. Project Manager may be an employee of or an independent consultant to City. When Project Manager is referred to within the Contract Documents and no Project Manager has in fact been designated, then the matter shall be referred to City. The term Project Manager shall be construed to include employees of Project Manager and/or employees that Project Manager supervises. When the designated Project Manager is an employee of City, his or her authorized representatives on the Project will be included under the term Project Manager. If Project Manager is an employee of City Project Manager is the beneficiary of all Contractor obligations to City, including without limitation, all releases and indemnities.
 58. Project Manual: Project Manual consists of Bidding Requirements, Agreement, Bonds, Certificates, Contract Conditions, Drawings, and Specifications.
 59. Project Record Documents: All Project deliverables required under the Contract Documents, including without limitation, as built drawings; Installation, Operation, and Maintenance Manuals; and Machine Inventory Sheets.
 60. Provide: Furnish and install.
 61. Request for Information ("RFI"): A document prepared by Contractor requesting information regarding the Project or Contract Documents. The RFI system is also a means for City to submit Contract Document clarifications or supplements to Contractor.
 62. Request for Proposals ("RFP"): A document issued by City to Contractor whereby City may initiate changes in the Work or Contract Time as provided in Contract Documents.
 63. Request for Substitution ("RFS"): A document prepared by Contractor requesting substitution of materials as permitted and to the extent permitted in Contract Documents.
 64. RFI-Reply: A document consisting of supplementary details, instructions, or information issued by City that clarifies or supplements Contract Documents, and with which Contractor shall comply. RFI-Replies do not constitute changes in Contract Sum or Contract Time except as otherwise agreed in writing by City. RFI-Replies will be issued through the RFI administrative system.
 65. Samples: Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.
 66. Shop Drawings: All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.
 67. Shown: As indicated on Drawings.
 68. Site: The particular geographical location of Work performed pursuant to the Contract Documents.
 69. Specifications: The written portion of the Contract Documents consisting of requirements for materials, equipment, construction systems, standards, and workmanship for the Work; performance of related services.
 70. Specified: As written in Specifications.
 71. Subcontractor: A person or entity that has a direct contract with Contractor to perform a portion of the Work at the Site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and neutral in gender and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a

- separate contractor or subcontractors of a separate contractor.
72. **Substantial Completion:** The Work (or a specified part thereof) has progressed to the point where, in the opinion of City as evidenced by a notice or certificate of Substantial Completion, the Work is sufficiently complete, in accordance with Contract Documents, so that the Work (or specified part) can be utilized for the purposes for which it is intended, and unperformed or incomplete work elements are minor in nature; or if no such certificate is issued, when the Work (or specified part) is complete and ready for final payment as evidenced by written recommendation of City for final payment. The terms "Substantially Complete" and "Substantially Completed" as applied to all or part of the Work refer to Substantial Completion thereof.
73. **Supplemental Instruction:** A written directive from City to Contractor ordering alterations or Modifications that do not result in change in Contract Sum or Contract Time, and do not substantially change Drawings or Specifications.
74. **Testing and Special Inspection Agency:** An independent entity engaged to inspect and/or test the workmanship, materials, or manner of construction of buildings or portions of buildings, to determine if such construction complies with the Contract Documents and applicable codes.
75. **Time Impact Evaluation (TIE):** A written narrative and a schedule diagram depicting how the changed Work or other impact affects other scheduled activities, prepared by Contractor in conjunction with a Change Proposal Request (CPR) for Change Orders, Time Extensions, and Delays. See Document 01 3230 (Progress Schedules and Submittals), and Document 01 2600 (Modification Procedures).
76. **Underground Facilities:** All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities that have been installed underground to furnish any of the following services or materials: Electricity, gases, chemicals, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems, or water.
77. **Unit Price Work:** Shall be the portions of the Work for which a unit price is provided in Document 00 5200 (Agreement) or Section 01 1100 (Summary).
78. **Work:** The entire completed construction, or the various separately identifiable parts thereof, required to be furnished under the Contract Documents within the Contract Time. Work includes and is the result of performing or furnishing labor and furnishing and incorporating materials and equipment into the construction, and performing or furnishing services and furnishing documents, all as required by the Contract Documents including everything shown in the Drawings and set forth in the Specifications. Wherever the word "work" is used, rather than the word "Work," it shall be understood to have its ordinary and customary meaning.

B. Other Defined Terms

The following terms are not necessarily identified with initial caps; however they shall have the meaning set forth below:

1. Wherever words "as directed," "as required," "as permitted," or words of like effect are used, it shall be understood that direction, requirements, or permission of City is intended. Words "sufficient," "necessary," "proper," and the like shall mean sufficient, necessary, or proper in judgment of City. Words "approved," "acceptable," "satisfactory," "favorably reviewed," or words of like import, shall mean approved by, or acceptable to, or satisfactory to, or favorably reviewed by City.
2. Wherever the word "may" or "ought" is used, the action to which it refers is discretionary. Wherever the word "shall" or "will" is used, the action to which it refers is mandatory.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

DIVISION 1 GENERAL REQUIREMENTS**SECTION 01 4500****TESTING AND INSPECTION****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Regulatory requirements for testing and inspection.
 - 2. Contractor's quality control.
 - 3. Quality of the Work.
 - 4. Inspections and tests by governing authorities.
 - 5. Inspections and tests by serving utilities.
 - 6. Inspections and tests by manufacturer's representatives.
 - 7. Inspections by Independent Testing and Inspection Agency.

1.02 RELATED SECTIONS

- A. Document 00 7200 General Conditions
- B. Section 01 4100 Regulatory Requirements

1.03 CONTRACTOR'S QUALITY CONTROL

- A. Contractor's Quality Control: Contractor shall ensure that products, services, workmanship and site conditions comply with requirements of the Drawings and Specifications by coordinating, supervising, testing and inspecting the work and by utilizing only suitably qualified personnel.
- B. Quality Requirements: Work shall be accomplished in accordance with quality requirements of the Drawings and Specifications, including, by reference, all Codes, laws, rules, regulations and standards. When no quality basis is prescribed, the quality shall be in accordance with the best accepted practices of the construction industry for the locale of the Project, for projects of this type.
- C. Quality Control Personnel: Contractor shall employ and assign knowledgeable and skilled personnel as necessary to perform quality control functions to ensure that the Work is provided as required.

1.04 QUALITY OF THE WORK

- A. Quality of Products: Unless otherwise indicated or specified, all products shall be new, free of defects and fit for the intended use.
- B. Quality of Installation: All Work shall be produced plumb, level, square and true, or true to indicated angle, and with proper alignment and relationship between the various elements.
- C. Protection of Completed Work: Take all measures necessary to preserve completed Work free from damage, deterioration, soiling and staining, until Acceptance by the City.
- D. Standards and Code Compliance and Manufacturer's Instructions and Recommendations: Unless more stringent requirements are indicated or specified, comply with manufacturer's instructions and recommendations, reference standards and building code research report

requirements in preparing, fabricating erecting, installing, applying, connecting and finishing Work.

- E. Deviations from Standards and Code Compliance and Manufacturer's Instructions and Recommendations: Document and explain all deviations from reference standards and building code research report requirements and manufacturer's product installation instructions and recommendations, including acknowledgement by the manufacturer that such deviations are acceptable and appropriate for the Project.
- F. Verification of Quality: Work shall be subject to verification of quality by City or Architect/Engineer in accordance with provisions of the General Conditions of the Contract.
 - 1. Contractor shall cooperate by making Work available for inspection by City, Architect/Engineer or their designated representatives.
 - 2. Such verification may include mill, plant, shop, or field inspection as required.
 - 3. Provide access to all parts of the Work, including plants where materials or equipment are manufactured or fabricated.
 - 4. Provide all information and assistance as required, including that by and from subcontractors, fabricators, materials suppliers and manufacturers, for verification of quality by City or Architect/Engineer.
 - 5. Contract modifications, if any, resulting from such verification activities shall be governed by applicable provisions in the General Conditions of the Contract.
- G. Observations by Architect/Engineer: Periodic and occasional observations of Work in progress will be made by Architect/Engineer as deemed necessary to review progress of Work and general conformance with design intent.
- H. Limitations on Inspection, Test and Observation: Neither employment of independent testing and inspection agency nor observations by Architect/Engineer shall in any way relieve Contractor of obligation to perform Work in full conformance to all requirements of Contract Documents.
- I. Rejection of Work: City reserves the right to reject all Work not in conformance to the requirements of the Drawings and Specifications.
- J. Correction of Non-Conforming Work: Non-conforming Work shall be modified, replaced, repaired or redone by the Contractor at no change in Contract Sum or Contract Time.
- K. Acceptance of Non-Conforming Work: Acceptance of nonconforming Work, without specific written acknowledgement and approval of the City, shall not relieve the Contractor of the obligation to correct such Work.
- L. Contract Adjustment for Non-Conforming Work: Should City determine that it is not feasible or in City's interest to require non-conforming Work to be repaired or replaced, an equitable reduction in Contract Sum shall be made by agreement between City and Contractor. If equitable amount cannot be agreed upon, a Construction Change Directive will be issued and the amount in dispute resolved in accordance with applicable provisions of the General Conditions.

1.05 INSPECTIONS AND TESTS BY GOVERNING AUTHORITIES

- A. Regulatory Requirements for testing and Inspection: Comply with Uniform Building Code (UBC) requirements and all other requirements of governing authorities having jurisdiction.
- B. Inspections and Tests by Governing Authorities: Contractor shall cause all tests and inspections required by governing authorities having jurisdiction to be made for Work under this Contract.
 - 1. Such authorities include the Division of Occupational Safety and Health (Cal/OSHA), City of Berkeley Public Works Department, Fire Department, and similar agencies.
 - 2. Except as specifically noted, scheduling, conducting and paying for such inspections shall be solely the Contractor's responsibility.

1.06 INSPECTIONS AND TESTS BY SERVING UTILITIES

- A. Inspections and Tests by Serving Utilities: Contractor shall cause all tests and inspections required by serving utilities to be made for Work under this Contract. Scheduling conducting and paying for such inspections shall be solely the Contractor's responsibility.

1.07 INSPECTIONS AND TESTS BY MANUFACTURER'S REPRESENTATIVES

- A. Inspections and Tests by Manufacturer's Representatives: Contractor shall cause all tests and inspections specified to be conducted by materials or systems manufacturers to be made. Additionally, all tests and inspections required by materials or systems manufacturers as conditions of warranty or certification of Work shall be made, the cost of which shall be included in the Contract Sum.

1.08 INSPECTIONS BY INDEPENDENT TESTING AND INSPECTION AGENCY

- A. City will select an independent testing and inspection agency or agencies to conduct tests and inspections as indicated on Drawings, in Specifications and as required by governing authorities having jurisdiction.
- B. Responsibility for payment for tests and inspections shall be as indicated in schedule below. All time and costs for Contractor's service related to such tests and inspections shall be included in Contract Time and Contract Sum.
- C. Contractor shall notify City and, if directed by City, testing and inspection agency, when Work is ready for specified tests and inspections.
- D. Contractor shall pay for all additional charges by testing and inspection agencies and governing authorities having jurisdiction due to the following:
1. Contractor's failure to properly schedule or notify testing and inspection agency or authorities having jurisdiction.
 2. Changes in sources, lots or suppliers of products after original tests or inspections.
 3. Changes in means methods, techniques, sequences and procedures of construction which necessitate additional testing, inspection and related services.
 4. Changes in mix designs for concrete and mortar after review and acceptance of submitted mix design.
- E. Tests and inspections shall include the following:

<u>Section</u>	<u>Inspections and Tests</u>	<u>Paid by</u>
Section 312200- Earthwork	Materials and compaction	Paid by City.
Section 321000- Aggregate Base	Materials and compaction	Paid by City.
Section 321216- Asphalt Concrete	Compaction	Paid by Contractor.
Section 321312- Concrete Reinforcing & Miscellaneous Steel	Reinforcement strength	Paid by City.
Section 321313- Cast-in-Place Concrete	Slump Tests Compressive strength	Paid by City. Paid by City.

F. Test and Inspection Reports: After each inspection and test, one copy of report shall be promptly submitted each to Architect/Engineer, City, City's field representative, Contractor and to agency having jurisdiction (if required by Code).

1. Reports shall clearly identify the following:
 - a. Date issued.
 - b. Project name and number.
 - c. Identification of product and Specifications Section in which Work is specified.
 - d. Name of inspector.
 - e. Date and time of sampling or inspection.
 - f. Location in Project where sampling or inspection was conducted.
 - g. Type of inspection or test.
 - h. Date of test.
 - i. Results of tests.
 - j. Comments concerning conformance with Contract Documents and other requirements.
2. Test reports shall indicate specified or required values and shall include statement whether test results indicate satisfactory performance of products.
3. Samples taken but not tested shall be reported.
4. Test reports shall confirm that methods used for sampling and testing conform to specified test procedures.
5. When requested, testing and inspection agency shall provide interpretations of test results.
6. Verification reports shall be prepared and submitted, stating that tests and inspections specified or otherwise required for the project, have been completed and that material and workmanship comply with the Contract Drawings and Specifications. Verification reports shall be submitted at intervals not exceeding 6 months, at Substantial Completion of the Project, and at all times when Work of Project is suspended.

G. Contractor Responsibilities in Inspections and Tests:

1. Notify testing and inspection agencies 24 hours in advance of expected time for operations requiring inspection and testing services.
2. Deliver to laboratory or designated location, adequate samples of materials proposed to be used which require advance testing, together with proposed mix designs.
3. Cooperate with testing and inspection agency personnel, City's field representative, Architect/Engineer. Provide access to Work areas and off-site fabrication and assembly locations, including during weekends and after normal work hours.
4. Provide incidental labor and facilities to provide safe access to Work to be tested and inspected, to obtain and handle samples at the Project site or at source of products to be tested, and to store and cure test samples.
5. Provide, at least 15 calendar days in advance of first test or inspection of each type, a schedule of tests or inspections indicating types of tests or inspections and their scheduled dates.
6. Provide 24 hours advance notice to the Project Manager, Architect/Engineer of each test and inspection, as directed.
 - a. When tests or inspections cannot be performed after such notice , reimburse City for Testing Laboratory personnel and travel expenses incurred due to Contractor's negligence.

1.09 ADDITIONAL TESTING AND INSPECTION

- A. If initial tests or inspections made by the Testing Laboratory reveal that materials do not comply with Contract Documents, or if City has reasonable doubt that materials do not comply with Contract Documents, additional tests and inspections shall be made as directed.

1. If additional tests and inspections establish that materials comply with Contract Documents, all costs for such tests and inspections shall be paid by City.
2. If additional tests and inspections establish that materials do not comply with Contract Documents, all costs of such tests and inspections shall be paid by the contractor.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

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DIVISION 1 GENERAL REQUIREMENTS

SECTION 01 5200

TEMPORARY FACILITIES

PART 1 - GENERAL**1.01 RELATED DOCUMENTS**

- A. General Conditions Document 00 7200
- B. Supplemental General Conditions Document 00 7201

1.02 SUMMARY

- A. This section describes the temporary facilities required for the Project site. The Project site shall be maintained by Contractor as set forth in this section unless otherwise added to or superseded by the requirements of Document 00 7200 (General Conditions).

1.03 TEMPORARY FACILITIES

- A. Contractor shall obtain permits for, install and maintain in safe condition, whatever scaffolds, hoisting equipment, barricades, walkways, or other temporary structures which may be required to accomplish the work on the Project. Such structures shall be adequate for the intended use and capable of safely accepting all loads that may be imposed upon them. They shall be installed and maintained in accordance with all applicable State and local codes and regulations.
- B. Contractor shall provide and maintain temporary heat from an approved source whenever in the course of the Work it may become necessary for curing and drying of materials, or to warm spaces as may be required for the installation of materials or finishes.
- C. Contractor shall provide and maintain any and all facilities that may be required for dewatering in order that work may proceed on the Project. If it is necessary for dewatering to occur continually, Contractor shall have on hand whatever spare parts or equipment that may be required to prevent interruption of dewatering.
- D. Contractor shall provide and maintain all utility services necessary to perform the work under this Contract.
- E. Materials, tools, accessories, etc., shall be stored only where directed by City. Storage area shall be kept neat and clean. Security of stored items shall be Contractor's responsibility.
- F. Flammable materials stored on site, shall be stored in a safe and secure manner per the manufacturer's direction. Extra precautions, including clear identification, shall be the responsibility of Contractor.
- G. Contractor shall maintain an office at the Project site that will be his headquarters for the Project. Any communications delivered to this office shall be considered as delivered to Contractor. Location and size of office shall be such that it will adequately serve the needs of Contractor's superintendent and assistants in the performance of their duties.
- H. Contractor shall promptly remove all such temporary facilities when they are no longer needed for the work or for completion of the Project, mutually agreed upon by Contractor and City.

1.04 SIGNS

- A. No signs may be displayed on or about the City's property (except those required by law) without the City's specific approval; the size, content, and location to be as specified by the

City.

1.05 USE OF ROADWAYS AND WALKWAYS

- A. Contractor shall never block or interfere with use of any existing roadway, walkway or other facility for vehicular or pedestrian traffic, from any party entitled to use it. Wherever and whenever such interference becomes necessary for the proper and convenient performance of the Work, and no satisfactory detour route exists, Contractor shall, before beginning the interference, notify City and post signs at least 72 hours in advance of such interference, and provide a satisfactory detour, including temporary bridge if necessary, or other proper facility for traffic to pass around or over the interference. Contractor shall maintain the detour in a safe and satisfactory condition as long as the interference continues, all without extra payment unless otherwise expressly stipulated in the Specifications.
- B. Contractor shall at all times comply with any and all requirements applying to the work under the transportation, circulation and parking mitigation measures, truck and construction access plan.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

DIVISION 1 GENERAL REQUIREMENTS**SECTION 01 5526****TRAFFIC CONTROL**

Contractor shall provide traffic control throughout the project as needed for the various traffic situations and street configurations in full conformance with the latest "California Manual on Uniform Traffic Control Devices and the Federal Highway Administration (FHWA) Manual of Uniform Traffic Control Devices (MUTCD) latest edition, as amended for use in California)" herein after referred to as Traffic Control Manual. The Traffic Control Manual may be obtained online at
<https://dot.ca.gov/programs/safety-programs/camutcd/camutcd-files>

As required, the Contractor shall submit a Traffic Control Plan to the City of Berkeley's Transportation Division or the California Department of Transportation (Caltrans).

Construction area signs and temporary traffic control devices shall be furnished, installed, maintained and removed by the Contractor. Traffic signage, e.g., warning signs and detour signs, may be required for this project. Contractor shall be responsible for placing all barricades for perimeter street closures as required. Per Section 501.10 – Traffic Control of the General Provisions, at main entry and exit points of each work location, the Contractor shall provide a 30" x 30" sign advising the public of the anticipated period of time that traffic delays may be anticipated. This sign will also include name and telephone number of the Contractor along with starting and completion dates of the contract. Sign will be erected 7 calendar days in advance of any work.

Construction work requiring traffic control on San Pablo Avenue (State Route 123) or Ashby Avenue (State Route 13) will require an encroachment permit from Caltrans. Contractor is solely responsible for obtaining and abiding by any necessary encroachment permits. The permit fees and other associated costs to obtain the required permits from the State of California shall be included in the cost bid for this item. Contractor shall be responsible for providing traffic control plan for encroachment permit to and obtaining approval of said traffic control plan from State of California. Contractor shall be responsible for all notification of work to, application for and obtaining work authorization number from Caltrans. Any damages arising from work related to encroachment permit shall be the responsibility of the Contractor.

The Contractor shall be responsible for posting "No Parking" signs a minimum of four calendar days in advance of concrete work, paving operations, failed area, and planning work so as to comply with the City's construction notification requirement of 4 days. Cones shall not be used as barricades. "No Parking" signs may be obtained from the City at no cost to the Contractor. The "No Parking" signs shall be updated as necessary. The Contractor shall check and maintain (e.g., re-install missing signs, reposition displaced barricades, etc.) postings on a regular basis prior to start of work.

If traffic is to be detoured over a centerline or detoured in advance of the work, detour plans must be part of the submitted Traffic Control plans and approved by the City prior to starting work. Police, Fire and Public Works Department shall be notified by the contractor at least four calendar days in advance of any work which will interfere with the normal flow of vehicular or pedestrian traffic. Intersection closure may only occur if the two adjacent intersections remain open, unless otherwise approved by the City. The Contractor shall coordinate his traffic control/diversion plan with the City, a minimum of 3 weeks prior to starting work, to assure that traffic is diverted in a safe and convenient manner.

Truck routes shall be approved by the City prior to start of work.

Truck traffic is not allowed on Marin Avenue within the City of Albany. Personal vehicles of the Contractor's employees shall not be parked within the area of work.

A minimum of one (paved) traffic lane, not less than 12 ft. wide, shall remain open for use by public traffic during construction operations. When construction operations are not actively in progress, not less than two such lanes shall be open to public traffic. The Contractor may be allowed to close residential streets if approved in writing in advance by the City. No work that interferes with public traffic shall be performed between 6:00 p.m. and 7:00 a.m.

Start of work shall be no earlier than 7:00 a.m. No work process, including starting, warm up, and delivery of equipment, shall be done outside of work hours. The use of vehicle horns to alert residents to move their vehicles out of the construction zone is not permitted. The Contractor should attempt to locate vehicle owners by knocking on doors.

The full width of the traveled way shall be open for use by public traffic on Saturdays, Sundays and designated legal holidays, and when construction operations are not actively in progress, unless specified otherwise.

Minor deviations from the requirements of this section concerning hours of work may be permitted upon the written request of the Contractor, if in the opinion of the City, public traffic will be better served and the work expedited. Such deviations shall not be adopted until the City provides written approval.

The traffic control system shall consist of closing traffic lanes in accordance with the Traffic Control Manual. Signs and other devices for the traffic control system shall conform to the Traffic Control Manual.

If any component in the traffic control system is damaged, displaced or ceases to operate or function as specified, from any cause during the progress of the work, the Contractor shall immediately repair said component to its original condition or replace said component and shall restore the component to its original location.

Lane closures may be made for work periods only. At the end of each work period, all components of the traffic control system shall be removed from the traveled way, shoulder and auxiliary lanes. If the Contractor so elects, said components may be stored at selected central locations approved by the City within the limits of the public right-of-way.

Sufficient barricades and flashing lights shall also placed to supplement all traffic signs used to divert and control traffic. Signs and barricades shall be checked periodically every day and replaced or repaired as necessary. Any hazardous conditions shall be immediately eliminated.

The Contractor, at the end of each day, shall provide ADA compliant pedestrian and vehicle crossings at all street intersections. If the project is left open overnight, it shall be graded in such a way that pedestrians and vehicles can safely pass through the project. Temporary concrete, asphalt, or wood ramps shall be installed and maintained at all locations where existing ramps have been temporarily removed.

Cleanliness is extremely important. Dust producing conditions shall be eliminated as soon as they are created.

If Contractor violates any of these provisions, a fine of \$1,000 will be assessed for the first violation, \$5,000 for the second and \$10,000 for the third and further subsequent violations.

ACCESS AND EGRESS

The Contractor shall endeavor to cooperate with all business owners and residents occupying properties fronting on the streets in the matter of access and egress. **Contractor shall maintain a clear and accessible pedestrian corridor.**

Where a business property has more than two vehicular paths of access, one path, 10 feet in width, shall remain open during all business hours, unless accepted by the City.

LANE CLOSURES

No lane closures shall be permitted on the following streets Monday through Friday between 7:00 A.M. – 9:00 A.M. and 4:00 P.M. – 6:00 P.M., and Saturdays between 10:00 A.M. – 2:00 P.M., unless approved in advance by the City, if it can be explained why such closure cannot reasonably be avoided. On Saturdays when UC football games are scheduled all construction-related lane closures along these corridors must be reopened at least 4 hours before the start of the game and remain open for 2 hours after the conclusion of the game.

Major Streets:

- University Avenue
- San Pablo Avenue
- Shattuck Avenue
- Telegraph Avenue
- Sacramento Street
- Martin Luther King Jr. Way
- Ashby Avenue
- College Avenue
- Gilman Avenue
- Adeline Street

Notwithstanding the above, the City reserves the right to review and comment on each individual traffic control plan based on its own merits.

Note: Routine maintenance, inconvenience to construction method or schedule, or adverse impacts on cost of work will generally not be accepted as grounds for exceptions.

END OF SECTION

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DIVISION 1 GENERAL REQUIREMENTS

SECTION 01 5700

TEMPORARY CONTROLS

PART 1 - GENERAL**1.01 RELATED DOCUMENTS**

- A. General Conditions Document 00 7200
- B. Supplemental General Conditions Document 00 7201

1.02 SUMMARY

- A. This section describes the temporary controls required for the Project site. The Project site shall be maintained by Contractor as set forth in this section unless otherwise added to or superseded by the requirements of Document 00 7200 (General Conditions).

1.03 TEMPORARY CONTROLS

- A. Contractor shall obtain permits for, install and maintain in safe condition, whatever scaffolds, equipment, shoring, barricades, walkways, or other temporary structures which may be required to accomplish the Work. Such items shall be adequate for the intended use and shall be installed and maintained in accordance with all applicable State and local codes and regulations.
- B. The Contractor shall perform a pre-construction audio/video tape survey and provide supplemental photographic documentation to adequately document the condition of existing improvements. It is the responsibility of the Contractor to adequately document the condition of existing improvements and the Contractor may be held liable for any damage or condition whose pre-existence he/she is unable to document. No additional compensation for such tape survey and still photographs will be allowed.
- C. Upon notification of the City, the Contractor shall correct any deficiencies of the temporary controls within 72 hours. The City may request City crews or contract with another contractor to perform the necessary work and repairs if the deficiencies have not been corrected after the 72-hour notification. The Contractor shall pay the cost of the work performed by the City crews or other contractor plus an additional seventy percent (70%) surcharge by deduction from payment due on the contract.
- D. The Contractor shall begin cleanup operation at least one hour before the end of each day's work, clean all paved portions of the project and paved streets leading from the project that have dust-producing materials or debris deposited upon them. The work areas shall be swept clean at the end of each day's work and at other times when directed by the City.

1.04 DUST AND DEBRIS CONTROLS

- A. The Contractor shall be responsible for controlling dust in the air and rocks, debris, mud or dirt which are scattered as a result of his operations on the job. The Contractor shall be responsible for cleaning all mud, rock, dust, dirt, and debris-producing materials that originate in the project area and are deposited on other public or private property by truck tires, spillages, or by other means. The Contractor shall have suitable and adequate street cleaning equipment on the project site at all times.
- B. The Contractor shall endeavor, whenever possible, to restrict the use of water to control dust for his convenience in order to conserve water during drought situations or

mandated rationing required by the Water Utility Company. Whenever flushing of streets or any other work is necessary, the Contractor shall provide filter materials at the catch basin to retain any debris and dirt flowing into the City's drainage system.

- C. The cost of the above work, including the providing of barricades, water and other materials, labor, and equipment shall be at the sole cost and expense of the Contractor.
- D. The City may determine that an emergency exists when dust, rocks, debris, mud, or dirt are scattered in the public right of way or in the private properties as a result of Contractor's activities and/or deterioration of such conditions due to rain. The emergency conditions may also be declared when traffic or the Contractor's equipment travelling through a job causes dust to fly or rocks, debris, mud, or dirt to be scattered. Similar emergency conditions may be determined by the City's Representative if the storage of materials, tools, or any other equipment related to the project, in the public rights of way, is causing any obstruction or blocks access to the neighboring properties and/or dangerously placed without proper barricades and lights and/or backfill stockpiles or debris washing away into the street gutter and catch basins.

1.05 NOISE CONTROL

- A. Equipment which operates with noise levels in excess of 85 decibels measured on the A-weighted scale defined in ANSI S-1.4 at a distance of 100 feet from the equipment is prohibited.
- B. All equipment and impact tools shall have mufflers to comply with specified noise control.
- C. Use of unusually noisy equipment, such as jackhammers and roto-hammers is prohibited.
- D. Exterior construction work is limited to the hours of 8 AM to 5 PM.
- E. Cooperate with City if an ongoing construction activity becomes objectionable by its longevity, or by overlapping into an activity started later by the City. It is understood and agreed that both parties shall cooperate so that neither will be unduly inconvenienced by this requirement.
- F. Comply by requirements specified in the various sections.

1.06 CLEAN UP

- A. The Contractor shall not allow the site of the work to become littered with trash, rubbish, and waste material but shall maintain the same in a neat and orderly condition throughout the construction period. Cleanup, debris and dust control shall be a daily maintenance requirement. The City shall have the right to determine what is or is not trash, rubbish or waste material and the place and manner of disposal.
- B. The Contractor shall maintain a neat appearance to the work. Contractor shall promptly remove splattered concrete, asphalt, oil, paint, corrosive liquids and cleaning solutions from surfaces to prevent marring or other damage.
- C. Broken concrete debris, and unsuitable excavated native soil during construction shall be disposed of concurrently with its removal. If stockpiling is necessary all debris shall be placed in trash bins daily and shall be removed or disposed of weekly. Any waste shall not be buried on the site or disposed of into storm drains, sanitary sewers, streams, or waterways.
- D. Forms or falsework that are to be re-used shall be stacked neatly concurrently with their removal. Forms and falsework that are not to be re-used shall be disposed of concurrently with their removal.
- E. Full compensation for conforming to the provisions in this section, not otherwise provided for, shall be considered as included in prices paid for the various contract items of work involved and no additional compensation will be allowed therefore.
- F. Sidewalks, street area, parking strips, and driveway approaches must be kept reasonably

clean at all times during construction and be completely and carefully cleaned after the work has progressed beyond the immediate vicinity to the satisfaction of the City's Representative. Reasonable cleanup is defined as no dust, rock, or mud on any portion of the public right-of-way or the private properties as a result of the Contractor's work.

1.07 EMERGENCY CLEAN UP WORK

- A. In any case in which the Contractor fails to satisfactorily complete the cleanup work described in this section, the City may determine that an emergency exists. In the event an emergency is determined by the City, the Contractor will be notified by the City to correct the violation immediately. The Contractor shall immediately make available manual labor or mechanical equipment capable of handling the cleaning process. During such an emergency, City forces may be called upon to complete the cleanup work, or the City may contract for the cleanup work. All construction work shall be shut down during this cleanup work by the City/contract forces. The City may shut down further construction work until the violations are corrected to the satisfaction of the City. The cost of the work performed by City/Contract forces plus an additional 70% surcharge shall be paid by the Contractor by deduction from payment due him on the contract. No compensation shall be given to the Contractor for stoppage of work.
- B. Such action by the City, however, shall not relieve the Contractor of his responsibility for any damages which may occur before, during or after such action has been taken by the City, and shall place no liability upon the City.

1.08 FINAL CLEAN UP

- A. Upon completion of the work, and before acceptance and final payment, the Contractor shall clean the project areas and remove all surplus and discarded materials, falsework, rubbish and temporary structures and restore in an acceptable manner all property, both public and private, which has been damaged during the prosecution of the work, and shall leave the improvement in a neat and presentable condition throughout the entire length of the improvement under contract to the satisfaction of the City. If the Conditions as noted above are not corrected immediately, the City may declare an emergency and take necessary action in accordance with the Emergency Cleanup Work section of this specification.

1.09 CLEAN UP AND SAFETY

- A. If the Contractor stockpiles granular material in the gutter, he must provide a minimum 4" pipe below the stockpile in the gutter to accommodate typical gutter flow. Any lumber or stockpiles on the site, not ready for immediate use, shall be free of nails or torn edges that may cause injury. Any materials stockpiled in the street and any open excavation shall have barricades equipped with operative automatic flashers placed at each end. The Contractor shall maintain a neat appearance at all times. All material removed shall be disposed of off-site in a legal manner.
- B. The Contractor must take special precautions to protect the public and City employees from bodily and property damage resulting from the work. Contractor must exercise all necessary precautions to ensure a safe execution of the work.

1.10 CREEK PROTECTION

- A. The Contractor shall be responsible for and conduct all aspects of the work within the requirements of BMC Chapter 17.08 – PRESERVATION AND RESTORATION OF NATURAL WATERCOURSES (Creek Ordinance), and any other creek protection requirements by other agencies.
- B. Portions of Work involving a creek channel may not be permitted between October 15 through April 15 or other dates as may be stipulated in applicable permits.

- C. Any work between creek banks shall be conducted to not create conditions, which will allow erosion, and shall be fully restored to at least the same erosion resistant condition as before the Work.
- D. Complying with the requirements of creek protection shall include but not be limited to scheduling the Work around any time periods prohibiting work within creek limits, installing erosion control measures and employing appropriate BMPs for controlling erosion, monitoring, updating and modifying BMPs to meet the requirements for changing site conditions to comply with erosion control and creek protection, replanting creek banks to reestablish erosion resistance and bank stability.

1.11 PROJECT SITE MAINTENANCE

- A. Water Pollution Control. The intent of these requirements is to enforce federal, state, and other local agencies' regulations that prohibit storm water pollution at construction sites. Storm drains discharge directly to creeks and the Bay without treatment, and discharge of pollutants (i.e., any substance, material, or waste other than uncontaminated storm water) into the storm drain system is strictly prohibited.
- B. The term "storm drain system" shall include storm water conduits, storm drain inlets and other storm drain structures, street gutters, channels, watercourses, creeks, lakes, and the San Francisco Bay.
- C. For the purpose of eliminating storm water pollution, the Contractor shall implement effective control measures at construction sites. There are several publications that provide guidance on selecting and implementing effective control measures known as Best Management Practices (BMPs). BMPs include schedules of activities, prohibition of specific practices, general good housekeeping practices, operational practices, pollution prevention practices, maintenance procedures and other management procedures to prevent the discharge of pollutants directly or indirectly to the storm drain system. BMPs also include the construction of some facilities that may be required to prevent, control, and abate storm water pollution. The reference publications are as follows:
 1. California Storm Water Best Management Practice Handbook - Industrial/Commercial
 2. California Storm Water Best Management Practice Handbook - Construction ActivityThese handbooks may be purchased from Blue Print Service (BPS), 1700 Jefferson St, Oakland, CA 94612.
 3. Manual of Standards for Erosion and Sediment Control Measures by the Association of Bay Area Governments (ABAG).
 4. Heavy Equipment Operation, Fresh Concrete & Mortar Application, Painting & Application of Solvents & Adhesives, Roadwork & Paving Activities, General Construction & Site Supervision, Parking Lots and Finish the Pour RightThese brochures are available at the Engineering Division, 1947 Center Street, 4th Floor, Berkeley, CA 94704.

1.12 STORMWATER POLLUTION CONTROL

- A. Stormwater Pollution Control. The intent of these requirements is to comply with federal, state, and other local agencies' regulations that prohibit non-stormwater discharges to storm drain sewer systems, creeks and San Francisco Bay. Storm drain sewers discharge directly to creeks and the Bay without treatment, and discharge of pollutants (any substance, material, or waste other than rainfall derived stormwater) into the storm drain sewer system is strictly prohibited. Further, the Contractor is informed that Federally Endangered species have been identified in creeks within the City Limits. The storm drain sewer system, pollutants, and other relevant information are further defined in

Berkeley Municipal Code (BMC) Chapter 17.20 DISCHARGE OF NON-STORMWATER INTO CITY'S STORM DRAIN SYSTEM – REDUCTION OF STORMWATER POLLUTION, and the City's stormwater NPDES (National Pollutant Discharge Elimination System) Permit No. CAS612008. These documents are available upon request.

- B. Best Management Practices (BMP) and Source Control. The contractor shall use appropriate BMPs and source control techniques on the site(s) at all times, regardless of time of year or rainfall conditions, in order to prohibit the discharge of non-stormwater discharges into the storm drain sewer system, creeks, and Bay. BMPs shall be in conformance with the California Stormwater Quality Association's "Stormwater Best Management Practice Handbook", current edition.
- C. Water Pollution Control Plan (WPCP) and Coordinator. The Contractor shall prepare, submit for favorable review by the City, and implement a WPCP which shall contain at a minimum the items included in this section.
 - 1. The Contractor shall designate an individual (to be approved by the City) available at all times of sufficient authority to halt work and implement BMPs and source control measures for the Contractor and all sub-contractors, suppliers, and other personnel that may be at the construction site(s), to prevent non-stormwater discharges from the construction site(s). This individual shall be the contact person for all matters of the project regarding non-stormwater discharges.
 - 2. The WPCP shall show the locations of all storm drains, storm drain pipes, creeks, creek culverts, points of entry (catch basins, inlets, outlets), and other features through which stormwater flows.
 - 3. The WPCP shall identify each point of entry and show how each entry point will be protected. The WPCP shall include a protocol for allowing drainage to flow properly during rainfall events WHILE STILL PREVENTING non-stormwater discharges from entering the storm drains, creeks, and Bay.
 - 4. The WPCP shall include descriptions and sketches of all BMPs, show locations and describe protocols for implementing and maintaining the following BMPs for but not limited to material storage, dewatering operations, bypass pumping, saw-cutting operations, pavement operations, concrete operations, grading and excavation operations, spill prevention and control, vehicle and equipment cleaning, vehicle and equipment operation and maintenance, litter control, dust control, pavement cleaning, and construction waste management.
 - 5. All employees, subcontractors, suppliers, and any others involved with the construction site(s) shall be trained in implementing, the importance of, and purpose of the WPCP.
 - 6. The WPCP shall be updated to meet changing stages of the construction site(s). Work shall not begin without the City completing its review and finding no exceptions taken on the WPCP and finding at City's sole discretion that the WPCP meets the intent and goals of the project.
 - 7. In addition, the Contractor shall observe the following guidelines:
 - a. Paving during wet weather:
 - i. No paving while it is raining.
 - ii. No paving of the top lift of asphalt concrete (AC) on any day that experiences $\frac{1}{4}$ " of rain in a twenty-four period.
 - iii. No paving of bottom lift if previous seventy-two (72) hour period experienced more than $\frac{1}{2}$ " of rain, unless directed by the City Engineer or his designee.
 - b. Store materials as required by BMPs.

- c. Cover inlets and manholes when applying asphalt, seal coat, tack coat, slurry seal, fog seal, etc., and while sawcutting, grooving, and grinding, etc.
- d. Place drip pans or absorbent materials under equipment when not in use.
- e. During wet weather, store paving equipment indoors or cover with tarp or other waterproof covering.
- f. Sweep site daily to prevent sand, gravel or excess asphalt from entering or being transported by rain into the storm drain system.
- g. Keep ample supplies of drip pans or absorbent materials on-site.
- h. If paving involves Portland cement concrete:
 - i. Do not wash out concrete trucks into storm drains, open ditches, streets, streams, etc. The Contractor shall prevent the discharge of pollutants from concrete operations by using measures to prevent run-on and run-off pollution, properly disposing of wastes, and by implementing the following BMP's:
 - a. Store all materials in waterproof containers or under cover away from drain inlets or drainage areas.
 - b. Avoid mixing excess amounts of Portland cement materials. Dispose of any excess materials properly.
 - c. Whenever possible, perform washout of concrete trucks off-site where discharge is controlled and not permitted to discharge to the storm drain system.
 - ii. For on-site washout:
 - a. Locate washout area at least fifty (50) feet from storm drains, open ditches or other water bodies, preferably in a dirt area.
 - b. Confine run-off from this area by constructing a temporary pit or bermed area large enough for the liquid and solid waste.
 - iii. Wash out concrete wastes into the temporary pit where the concrete can set, be broken up and then disposed of properly. If the volume of water is greater than what will allow concrete to set, allow the wash water to infiltrate and/or evaporate, if possible. Remove or vacuum the remaining silt and debris from the ponding or bermed area and dispose of it properly.
 - iv. Dispose of waste water from washing of exposed aggregate to dirt area. The dirt area shall be adequate to contain all the waste water and once the waste water has infiltrated, any remaining residue must be removed.
 - v. Collect and return sweepings from exposed aggregate concrete to a stockpile or dispose of the waste in trash container.
- D. Training. Contractor is responsible for ensuring all personnel, laborers, sub-contractors, suppliers, and any other personnel that are involved with the Work are trained in the importance of preventing non-stormwater discharges. Each worker shall be trained or certified as being trained before being allowed to work. Before any work begins, the Contractor shall submit and certify under penalty of perjury a list of all workers who have been trained on the importance of pollution prevention, BMP and source control operation and maintenance, and recognize the authority of the City to stop the work in the event of a non-stormwater discharge. The training shall include as a minimum, review of the BMP and WPCP, and all BMPs (including BMP operation and maintenance) that are planned for the Work.
- E. Enforcement. The City has the authority through this contract and appropriate sections of the BMC to enforce any portions of this section. City enforcement may include but is not limited to: citations, orders to abate, bills for City cleanup costs and administration, civil suits, and criminal charges and enforcement. Enforcement action by the City does not void or suspend any enforcement actions by other agencies, and actions by the City and other agencies shall be cumulative.
- F. Submittals and Contract Time. Contractor is cautioned and advised to have appropriately trained staff with any applicable certifications prepare all submittals for Storm Water

Pollution Controls including the WPCP, and have appropriately trained staff available to meet with City staff to review the submittals. It is considered reasonable that the Contractor shall make a complete and acceptable submittal at least by the second submission. The City reserves the right to deduct monies from payments due Contractor to cover additional costs of City's and Architect/Engineer's review beyond the second submission. Illegible submittals will be rejected and returned to the Contractor.

- G. Payment. There shall be no separate pay item for complying with the provisions of this section, unless a separate pay item is provided in the bid schedule.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

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DIVISION 1 GENERAL REQUIREMENTS**SECTION 01 7329****CUTTING AND PATCHING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Contractor shall be responsible for all cutting, fitting, and patching required to complete the work and to:
 1. Make its several parts fit together properly,
 2. Uncover portions of the 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. Provide routine penetrations of nonstructural surfaces for installation of electrical conduit, plumbing, and ductwork,
 6. Remove Samples of installed work as specified for testing.

1.02 SUBMITTALS

- A. Submit a written request to the Architect/Engineer two weeks in advance of executing any cutting or alteration that affects the following and is not specifically indicated on the Drawings as part of the Scope of Work:
 1. Work of the City or any separate contractor,
 2. The structural value or integrity of any element of the completed building,
 3. The integrity or effectiveness of weather-exposed or moisture-resistant elements or systems,
 4. The efficiency, operational life, maintenance, and safety of operational elements,
 5. The visual qualities of sight-exposed elements.
- B. The request shall include:
 1. The necessity for cutting or alteration,
 2. The effect on the work of the City or any separate contractor or on the structural or weatherproof integrity of the building,
 3. Description of the Proposed Work:
 - a. The scope of cutting, patching, alteration, or excavation,
 - b. The trades who will execute the work,
 - c. The products proposed to be used,
 - d. The extent of refinishing to be done.
 4. Alternatives to cutting and patching,
 5. Cost proposal, when applicable,
 6. Written permission of any separate contractor whose work will be affected.
- C. Should conditions of the work or the schedule indicate a change of products from the original installation, submit a request for substitution per Section 00 6325 Substitution Request Form.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. Comply with specifications and standards for each specific product involved.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine existing conditions of the Project, including elements subject to damage or to movement during cutting and patching.
- B. After uncovering work, examine the conditions affecting the installation of products or performance of the Work.
- C. Report unsatisfactory or questionable conditions to the Project Manager in writing. Do not proceed with the work until the Project Manager has provided further instructions.

3.02 PREPARATION

- A. Provide adequate temporary support as necessary to assure the structural value or integrity of the affected portion of the work.
- B. Provide devices and methods to protect other portions of the Project from damage.
- C. Provide protection from the elements for that portion of the Project that may be exposed by cutting and patching work.

3.03 PERFORMANCE

- A. Execute cutting and demolition by methods that will prevent damage to other work and will provide proper surfaces to receive installation of repairs.
- B. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.
- C. All plumbing, mechanical, and electrical system elements shall be concealed, unless indicated otherwise.
- D. Restore work which has been cut or removed; install new products to provide completed work in accordance with requirements of Contract Documents.
- E. Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- F. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes.
 1. For continuous surfaces, refinish to nearest intersection.
 2. For an assembly, refinish the entire unit.

END OF SECTION

DIVISION 1 GENERAL REQUIREMENTS

SECTION 01 7413

PROJECT CLEANING

PART 1 - GENERAL**1.01 SUMMARY**

- A. Maintain Project Site, surrounding areas and public properties free from accumulations of waste, debris, and rubbish, caused by operations.
- B. At completion of Work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all sight-exposed surfaces; leave Project Site clean and ready for occupancy.

1.02 GENERAL

- A. Conduct cleaning and disposal operation in accord with legal requirements.
 - 1. Do not burn or bury rubbish and waste materials on Project Site.
 - 2. Do not dispose of volatile wastes in storm or sanitary drains.
- B. Hazards control:
 - 1. Store volatile wastes in covered metal containers, and remove from premises daily.
 - 2. Prevent accumulation of wastes which create hazardous conditions.
 - 3. Provide adequate ventilation during use of volatile or noxious substances.

Note: Care shall be taken that discharge of volatile or noxious exhaust shall be shielded from air intakes of hospital mechanical systems.

1.03 MATERIALS

- A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.
- B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

1.04 DUST CONTROL

- A. Clean interior spaces prior to start of finish painting, and continue cleaning as required until painting is completed.

1.05 DURING CONSTRUCTION

- A. Execute cleaning daily to ensure Project Site, City's premises, adjacent and public properties are maintained free from accumulations of waste materials and rubbish.
- B. Wet down dry materials and rubbish to control dust.
- C. At reasonable intervals during progress of Work, clean Project Site and public properties, and dispose of waste materials, debris and rubbish.
- D. Provide on Project Site dump containers for collection of waste materials, debris and rubbish. Hospital waste containers shall not be used for construction waste.
- E. Remove waste materials, debris and rubbish from City's premises and legally dispose of off City's property.
- F. Vacuum clean interior areas when ready to receive finish painting, and continue vacuum cleaning on an as-needed basis until building is ready for substantial completion or

occupancy.

- G. Handle materials in a controlled manner with as few handlings as possible. Do not drop or throw materials.
- H. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

1.06 FINAL CLEANING

- A. Employ experienced workers, or professional cleaners for final cleaning.
- B. In preparation for Substantial Completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of accessible concealed spaces.
- C. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed finished surfaces; polish surfaces so designated to shine finish.
- D. Repair, patch and touch up marred surfaces to specified finish, and to match adjacent surfaces.
- E. Broom clean paved surfaces.
- F. Keep Project clean until it is occupied by the City.
- G. Clean equipment and fixtures to a sanitary condition.
- H. Clean or replace, if required, filters of operating equipment.
- I. Clean Debris from roofs, gutters, downspouts and drainage systems.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

DIVISION 1 GENERAL REQUIREMENTS**SECTION 01 7419****CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL****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. This Section includes administrative and procedural requirements for the following:
1. Salvaging and recycling nonhazardous demolition and construction waste.
 2. Disposing of nonhazardous demolition and construction waste.
- B. Related Sections include the following:
1. Division 01 Section "Temporary Facilities and Controls" for environmental-protection measures during construction.

1.03 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. 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.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.04 PERFORMANCE REQUIREMENTS

- A. General: Develop waste management plan that results in end-of-Project rates for a minimum salvage/recycling percent by weight of total waste generated by the Work, as required by the Berkeley Municipal Code 19.37 Berkeley Green Code..
- B. Salvage/Recycle Goals: Owner's goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible.
1. Demolition Waste:
 - a. Asphaltic concrete paving.
 - b. Concrete.
 - c. Concrete reinforcing steel.
 - d. Brick.
 - e. Concrete masonry units.

- f. Wood studs.
- g. Wood joists.
- h. Plywood and oriented strand board.
- i. Wood paneling.
- j. Wood trim.
- k. Structural and miscellaneous steel.
- l. Rough hardware.
- m. Roofing.
- n. Insulation.
- o. Doors and frames.
- p. Door hardware.
- q. Windows.
- r. Glazing.
- s. Metal studs.
- t. Gypsum board.
- u. Acoustical tile and panels.
- v. Carpet.
- w. Carpet pad.
- x. Demountable partitions.
- y. Equipment.
- z. Cabinets.
- aa. Plumbing fixtures.
- bb. Piping.
- cc. Supports and hangers.
- dd. Valves.
- ee. Sprinklers.
- ff. Mechanical equipment.
- gg. Refrigerants.
- hh. Electrical conduit.
- ii. Copper wiring.
- jj. Lighting fixtures.
- kk. Lamps.
- ll. Ballasts.
- mm. Electrical devices.
- nn. Switchgear and panelboards.
- oo. Transformers.

2. Construction Waste:

- a. Site-clearing waste.
- b. Masonry and CMU.
- c. Lumber.
- d. Wood sheet materials.
- e. Wood trim.
- f. Metals.
- g. Roofing.
- h. Insulation.
- i. Carpet and pad.
- j. Gypsum board.
- k. Piping.
- l. Electrical conduit.
- m. Packaging: Regardless of salvage/recycle goal indicated above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
 - 1. Paper.
 - 2. Cardboard.
 - 3. Boxes.
 - 4. Plastic sheet and film.

5. Polystyrene packaging.
6. Wood crates.
7. Plastic pails.

1.05 SUBMITTALS

- A. Waste Management Plan: Submit **3** copies of plan within **7** days of date established for the Notice to Proceed.
- B. See Evaluations for example of Waste Reduction Progress Reports in paragraph below.
- C. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit 3 copies of report. Include the following information:
 1. Material category.
 2. Generation point of waste.
 3. Total quantity of waste in tons
 4. Quantity of waste salvaged, both estimated and actual in tons
 5. Quantity of waste recycled, both estimated and actual in tons
 6. Total quantity of waste recovered (salvaged plus recycled) in tons
 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- D. Waste Reduction Calculations: Before request for Substantial Completion, submit **3** copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- E. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- F. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- G. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- H. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.06 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Green Building Professional. Waste management coordinator may also serve as Green Building coordinator.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

1.07 WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total

quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

D.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.01 PLAN IMPLEMENTATION

- A. General: Implement waste management plan as approved by Construction Manager. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 1. Comply with Division 01 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
 1. Distribute waste management plan to all relevant sub-contractor within 3 days of submittal return.
 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 2. Comply with Division 01 Section "Temporary Facilities and Temporary Controls" for controlling dust and dirt, environmental protection, and noise control.

3.02 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work:

1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until installation.
 4. Protect items from damage during transport and storage.
 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Owner's Use:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to Owner's storage area.
 5. Protect items from damage during transport and storage.
- C. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

3.03 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Receivers and Processors: List below is provided for information only; available recycling receivers and processors include, but are not limited to, the following

The City of Berkeley Transfer Station
1201 Second Streets, Berkeley, CA

- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
 1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 4. Store components off the ground and protect from the weather.
 5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.04 RECYCLING DEMOLITION WASTE

- A. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility.
- B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
- C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with

other metals.

1. Clean and stack undamaged, whole masonry units on wood pallets.
- D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
 1. Treated Wood Waste: Treated wood waste is required to be managed, stored, transported, and disposed of as hazardous waste per California State regulations. Treated wood waste is required to be transported and disposed of at a Class I hazardous waste landfill by a Hazardous Waste contractor.
- E. Metals: Separate metals by type.
 1. Structural Steel: Stack members according to size, type of member, and length.
 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- F. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- G. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- H. Plumbing Fixtures: Separate by type and size.
- I. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- J. Lighting Fixtures: Separate lamps by type and protect from breakage.
- K. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.
- L. Conduit: Reduce conduit to straight lengths and store by type and size.

3.05 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 2. Polystyrene Packaging: Separate and bag materials.
 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Site-Clearing Wastes: Chip brush, branches, and trees.
- C. Wood Materials:
 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
 3. Treated Wood Waste: Treated wood waste is required to be managed, stored, transported, and disposed of as hazardous waste per California State regulations. Treated wood waste is required to be transported and disposed of at a Class I hazardous waste landfill by a Hazardous Waste contractor.
- D. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.
 1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile

chipper or hammer mill. Screen out paper after grinding.

3.06 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION

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DIVISION 1 GENERAL REQUIREMENTS**SECTION 01 7700****CONTRACT CLOSEOUT****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section describes requirements and procedures for:
 - 1. Project cleaning.
 - 2. Testing of equipment and systems
 - 3. Substantial Completion
 - 4. Final Completion
 - 5. Close Out
 - 6. Warranties

1.02 SUBSTANTIAL COMPLETION

- A. Removal of Temporary Construction Facilities and Project Cleaning.
 - 1. Prior to Substantial Completion inspection: remove temporary materials, equipment, services, and construction; clean all areas affected by the Work; clean and repair damage caused by installation or use of temporary facilities; restore permanent facilities used during construction to specified condition.
- B. Equipment and Systems.
 - 1. Prior to Substantial Completion, Contractor shall start up, run for periods prescribed by City, operate, adjust and balance all manufactured equipment and Project systems, including but not limited to, mechanical, electrical, safety, fire, and controls.
 - 2. Demonstrate that such equipment and systems conform to contract standards and manufacturer's guarantees. Where applicable, use testing protocols specified, and if the contract is silent, then consistent with manufacturer's recommendations and industry standards.
- C. Procedure for Substantial Completion
 - 1. When Contractor considers Work or designated portion of the Work as Substantially Complete, submit written notice to City, with list of items remaining to be completed or corrected and explanation of why such items do not prevent City's beneficial use and occupancy of the Work for its intended purposes. Within reasonable time, City will inspect to determine status of completion.
 - 2. Should City determine that Work is not Substantially Complete, City will promptly notify Contractor in writing, listing all defects and omissions. Contractor shall remedy deficiencies and send a second written notice of Substantial Completion. City will reinspect the Work. If deficiencies previously noted are not corrected on reinspection, then pay the cost of the reinspection.
 - 3. When City concurs that Work is Substantially Complete, City will issue a written notice or certificate of Substantial Completion, accompanied by Contractor's list of items to be completed or corrected as verified by City.
 - 4. Manufactured units, equipment and systems that require startup must have been

started up and before a notice or certificate of Substantial Completion will be issued.

5. A punch list examination will be performed upon Substantial Completion. One follow-up review of punch list items for each discipline will be provided. If further Site visits are required to review punch list items due to incompleteness of the Work by Contractor, Contractor will reimburse City for costs associated with these visits.

1.03 FINAL COMPLETION

A. Requirements

1. Final Completion occurs when Work meets requirements for City's Final Acceptance.

B. Procedure

1. When Contractor considers Work is Finally Complete, submit written certification that:

- a. Contractor has inspected Work for compliance with Contract Documents, and all requirements for Final Acceptance have been met.
- b. Except for Contractor maintenance after Final Acceptance, Work has been completed in accordance with Contract Documents and deficiencies listed with Certificate of Substantial Completion have been corrected. Equipment and systems have been tested in the presence of City, and are operative.
- c. Project Record Documents are completed and turned over to City, and Work is complete and ready for final inspection.

2. In addition to submittals required by Contract Documents, provide submittals required by governing authorities and submit final statement of accounting giving total adjusted Contract Sum, previous payments, and sum remaining due.

3. Should City determine that Work is incomplete or Defective, City promptly will so notify Contractor, in writing, listing the incomplete or Defective items. Contractor shall promptly remedy the deficiencies and notify the City when it is ready for reinspection.

C. Final Adjustments of Accounts:

1. Submit a final statement of accounting to City, showing all adjustments to the Contract Sum and complete and execute Document 00 6530 (Agreement and Release of Claims).

2. If so required, City shall prepare a final Change Order for submittal to Contractor, showing adjustments to the Contract Sum that were not previously made into a Contract Modification.

D. Warranties

1. Execute Contractor's Submittals and assemble warranty documents, and Installation, Operation, and Maintenance Manuals, executed or supplied by Subcontractors, suppliers, and manufacturers. Provide table of contents and assemble in 8½ inches by 11 inches three-ring binder with durable plastic cover, appropriately separated and organized. Assemble in Specification Section order.

2. Submit material prior to final Application for Payment. For equipment put into use with City's permission during construction, submit within 14 calendar days after first operation. For items of Work delayed materially beyond Date of Substantial Completion, provide updated Submittal within 14 calendar days after acceptance, listing date of acceptance as start of warranty period.

3. Warranty Forms: Submit drafts to Owner for approval prior to execution. Forms shall not detract from or confuse requirements or interpretations of Contract Documents. Warranty shall be countersigned by manufacturers. Where specified, warranty shall be countersigned by Subcontractors and installers.

4. Rejection of Warranties: Owner reserves right to reject unsolicited and coincidental product warranties that detract from or confuse requirements or interpretations of Contract Documents.
 5. Term of Warranties: For materials, equipment, systems, and workmanship, warranty period shall be one year minimum from date of Final Completion of entire Work except where:
 - a. Detailed Specifications for certain materials, equipment or systems require longer warranty periods.
 - b. Materials, equipment or systems are put into beneficial use of City prior to Final Completion as agreed to in writing by City.
- E. Warranty of Title:
1. No material, supplies, or equipment for Work under Contract shall be purchased subject to any chattel mortgage, security agreement, or under a conditional sale or other agreement by which an interest therein or any part thereof is retained by seller or supplier. Contractor warrants good title to all material, supplies, and equipment installed or incorporated in Work and agrees upon completion of all Work to deliver premises, together with improvements and appurtenances constructed or placed thereon by Contractor, to City free from any claim, liens, security interest, or charges, and further agrees that neither Contractor nor any person, firm, or corporation furnishing any materials or labor for any Work covered by Contract shall have right to lien upon premises or improvement or appurtenances thereon. Nothing contained in this paragraph, however, shall defeat or impair right of persons furnishing materials or labor under bond given by Contractor for their protection or any rights under law permitting persons to look to funds due Contractor in hands of City.
- F. Turn-In. Contract Documents will not be closed out and final payment will not be made until all keys issued to Contractor during prosecution of Work and letters from property owners, pursuant to Contract Documents, are turned in to City.
- G. Release of Claims. Contract Documents will not be closed out and final payment will not be due or made until Document 00 6530 (Agreement and Release of Claims) is completed and executed by Contractor and City.
- H. Fire Inspection Coordination. Coordinate fire inspection and secure sufficient notice to City to permit convenient scheduling (if applicable).
- I. Building Inspection Coordination. Coordinate with City a final inspection for the purpose of obtaining an occupancy certificate (if applicable).

PART 2 - PRODUCTS – NOT USED**PART 3 - EXECUTION – NOT USED**

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DIVISION 1 GENERAL REQUIREMENTS

SECTION 01 7800

CLOSEOUT SUBMITTALS

PART 1 - GENERAL**1.01 SUMMARY**

- A. This section specifies administrative and procedural requirements for Project Record Documents.
- B. Project Record Documents required include:
 1. Marked-up copies of Contract Drawings
 2. Marked-up copies of Shop Drawings
 3. Newly prepared Drawings
 4. Marked-up copies of Specifications, Addenda and Change Orders
 5. Marked-up Project Data submittals
 6. Record Samples
 7. Field records for variable and concealed conditions
 8. Record information on Work that is recorded only schematically
- C. Specific Project Record Documents requirements that expand requirements of this Section are included in the individual Sections of Divisions 1 through 33.
- D. General Project closeout requirements are included in Section 01 7700, "Contract Closeout."
- E. Maintenance of Documents and Samples:
 1. Store Project Record Documents and samples in the field office apart from Contract Documents used for construction.
 2. Do not permit Project Record Documents to be used for construction purposes.
 3. Maintain Project Record Documents in good order, and in a clean, dry, legible condition.
 4. Make documents and samples available at all times for inspection by Architect and Project Manager.
- F. City will provide one set of sepia and one blueline set of the construction drawings and one project manual for the Contractor's use and copying during construction.

1.02 PROJECT RECORD DRAWINGS

- A. Mark-up Procedure: During the construction period, maintain a set of blueline or blackline prints of Contract Drawings and Shop Drawings for Project Record Document purposes. Label each document (on first sheet or page) "PROJECT RECORD" in 2 in. high printed letters. Keep record documents current. Note: A reference by number to a Change Order, RFI, RFQ, Field Order or other such document is not acceptable as sufficient record information on any record document. Do not permanently conceal any Work until required information has been recorded.
 1. Mark these Drawings to indicate the actual installation where the installation varies appreciably from the installation shown originally. Give particular attention to

information on concealed elements which would be difficult to identify or measure and record later. Items required to be marked include but are not limited to:

- a. Dimensional changes to the Drawings
 - b. Revisions to details shown on the Drawings
 - c. Depths of various elements of foundation in relation to main floor level or survey datum.
 - d. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
 - e. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
 - f. Establish locations of underground work, points of connection with existing utilities, changes in direction, valves, manholes, catch basins, capped stubouts, invert elevations, and similar items.
 - g. Provide actual numbering of each electrical circuit.
 - h. Field changes of dimension and detail.
 - i. Revisions to routing of piping and conduits
 - j. Revisions to electrical circuitry
 - k. Actual equipment locations
 - l. Duct size and routing
 - m. Changes made by Change Order
 - n. Details not on original Contract Drawings
2. Mark completely and accurately Project Record Drawing prints of Contract Drawings or Shop Drawings, whichever is the most capable of showing actual physical conditions. Where Shop Drawings are marked, show cross-reference on Contract Drawings location.
 3. Mark Project Record Drawing sets with red erasable colored pencil; use other colors to distinguish between changes for different categories of the Work at the same location.
 4. Mark important additional information which was either shown schematically or omitted from original Drawings.
 5. Note construction change directive numbers; alternate numbers; Change Order numbers and similar identification.
 6. Responsibility for Mark-up: Where feasible, the individual or entity who obtained Project Record Drawing data, whether the individual or entity is the installer, subcontractor, or similar entity, is required to prepare the mark-up on Project Record Drawings.
 - a. Accurately record information in an understandable and legible drawing technique.
 - b. Record data as soon as possible after it has been obtained. In the case of concealed installations, record and check the mark-up prior to concealment.
- B. Preparation of Transparencies: Immediately prior to inspection for Certification of Substantial Completion, review completed marked-up Project Record Drawings with the Project Manager]. When authorized, prepare a full set of correct transparencies of Contract Drawings and Shop Drawings.
1. Incorporate changes and additional information previously marked on print sets. Erase, redraw, and add details and notations where applicable. Identify and date each Drawing; include the printed designation "PROJECT RECORD DRAWINGS" in a prominent location on each Drawing.
 2. Refer instances of uncertainty to the Project Manager for resolution.
 3. Review of Transparencies: Before copying and distributing, submit corrected

transparencies and the original marked-up prints to the Project Manager and Architect/Engineer for review.

- a. Transparencies and the original marked-up prints will be returned to the Contractor for organizing into sets, printing, binding, and final submittal.
4. Copies and Distribution: After completing the preparation of transparency Project Record Drawings, print three blue-line or black-line prints of each Drawing, whether or not changes and additional information were recorded. Organize the copies into manageable sets. Bind each set with durable paper cover sheets, with appropriate identification, including titles, dates and other information on cover sheets.
 - a. Organize and bind original marked-up set of prints that were maintained during the construction period in the same manner.
 - b. Organize Project Record Drawings transparencies into sets matching the print sets. Place these sets in durable tube-type drawing containers with end caps. Mark the end cap of each container with suitable identification.
- C. Distribution of Marked up Drawings and Transparencies
 1. Submit the marked-up Project Record Drawings set, pdfs, transparencies, and five copy sets to the Project Manager for City's records.
- D. Shop Drawings and Samples: Maintain as record documents; legibly annotate Shop Drawings and Samples to record changes made after review.
- E. In addition to requirements of this Section, comply with supplemental requirements of Divisions 21 and 28 and Division 33.
 1. Divisions 21 through 28 and Division 33 of the specifications require the preparation of large scale, detailed Layout Drawings of the work of those divisions. These Layout Drawings are not shop drawings as defined by the General Conditions, but together with shop drawing or Layout Drawings of all other affected sections are used check, coordinate and integrate the work of the various sections
 2. Include these Layout Drawings as part of the As Built Documents.
- F. Delete Architect/Engineer title block and seal from documents.
- G. As-Built Documents are subject to review and acceptance by the City and Architect/Engineer.
- H. Submit documents to Project Manager with final Application for payment.

1.03 PROJECT RECORD SPECIFICATIONS

- A. During the construction period, maintain one copy of the Project Specifications, including addenda and modifications issued, for Project Record Document purposes.
 1. Mark the Project Record Specifications to indicate the actual installation where the installation varies substantially from that indicated in Specifications and Modifications issued. Note related Project Record Drawing information, where applicable. Give particular attention to substitutions, selection of product options, change order work, and information on concealed installation that would be difficult to identify or measure and record later.
 - a. In each Specification Section where products, materials or units of equipment are specified or scheduled, mark the copy with the proprietary name and model number of the product furnished.
 - b. Record the name of the manufacturer, catalog number, supplier and installer, and other information necessary to provide a record of selections made and to document coordination with Project Record Product Data submittals and maintenance manuals.

- c. Note related Project Record Product Data, where applicable, for each principal product specified, indicate whether Project Record Product Data has been submitted in maintenance manual instead of submitted as Project Record Product Data.
2. Upon completion of mark-up, submit Project Record Specifications to the Project Manager for City's records.

1.04 PROJECT RECORD PRODUCT DATA

- A. During the construction period, maintain one copy of each Project Record Product Data submittal for Project Record Document purposes.
 1. Mark Project Record Product Data to indicate the actual product installation where the installation varies substantially from that indicated in Project Record Product Data submitted. Include significant changes in the product delivered to the site, and changes in manufacturer's instructions and recommendations for installation.
 2. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 3. Note related Change Orders and mark-up of Project Record Drawings, where applicable.
 4. Upon completion of mark-up, submit a complete set of Project Record Product Data to the Project Manager for City's records.
 5. Where Project Record Product Data is required as part of maintenance manuals, submit marked-up Project Record Product Data as an insert in the manual, instead of submittal as Project Record Product Data.
 6. Each prime Contractor is responsible for mark-up and submittal of record Project Record Product Data for its own Work.
- B. Material, Equipment and Finish Data
 1. Provide data for primary materials, equipment and finishes as required under each specification section.
 2. Submit two sets prior to final inspection, bound in 8-1/2 inches by 11 inches three-ring binders with durable plastic covers; provide typewritten table of contents for each volume.
 3. Arrange by Specification division and give names, addresses, and telephone numbers of subcontractors and suppliers. List:
 - a. Trade names.
 - b. Model or type numbers.
 - c. Assembly diagrams.
 - d. Operating instructions.
 - e. Cleaning instructions.
 - f. Maintenance instructions.
 - g. Recommended spare parts.
 - h. Product data.

1.05 MISCELLANEOUS PROJECT RECORD SUBMITTALS

- A. Refer to other Specification Sections for miscellaneous record keeping requirements and submittals in connection with various construction activities. Immediately prior to Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Submit to the Project Manager for City's records. Categories of requirements resulting in miscellaneous records include, but are not limited to the following:

1. Field records on excavations and foundations
2. Field records on underground construction and similar work
3. Survey showing locations and elevations of underground lines
4. Invert elevations of drainage piping
5. Surveys establishing building lines and levels
6. Authorized measurements utilizing unit prices or allowances
7. Records of plant treatment
8. Ambient and substrate condition tests
9. Certifications received in lieu of labels on bulk products
10. Batch mixing and bulk delivery records
11. Testing and qualification of tradespersons
12. Documented qualification of installation firms
13. Load and performance testing
14. Inspections and certifications by governing authorities
15. Leakage and water-penetration tests
16. Fire resistance and flame spread test results
17. Final inspection and correction procedures

PART 2 - PRODUCTS – NOT USED**PART 3 - EXECUTION****3.01 RECORDING**

- A. Post changes and modifications to the Documents as they occur. Do not wait until the end of the Project. City may review Project Record Documents prior to each progress payment to see that the required information is being properly and faithfully recorded to assure compliance with this requirement. If Contractor has not complied with this requirement, the progress payment will be withheld until the Record Documents have been brought up to date.

3.02 SUBMITTAL

- A. At completion of Project, deliver Record Documents to Project Manager.
- B. Accompany submittal with transmittal letter containing:
 1. Date
 2. Project title and number
 3. Contractor's name and address
 4. Number and title of each record documents
 5. Certification that each document as submitted is complete and accurate, and signature of Contractor, or his authorized representative.

END OF SECTION

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DOCUMENT 00 0010

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END OF DOCUMENT

SECTION 02 4119

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 017300 "Execution" for cutting and patching procedures.
3. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
- E. Dismantle: To 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.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Engineering Survey: Submit engineering survey of condition of building.
- C. Proposed Protection Measures: Submit 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.
- D. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- E. Predemolition Photographs or Video: Submit before Work begins.
- F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- G. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.9 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site that are not wanted by the Owner will be permitted on site where diversion of waste from landfill can be accomplished.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.10 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective 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.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- D. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs and preconstruction videotapes.
 1. Comply with requirements specified in Section 013233 "Photographic Documentation."
 2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- 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, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 1. Arrange to shut off indicated utilities with utility companies.
 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - c. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - d. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - e. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.

3.5 SELECTIVE 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 demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 2. Neatly cut 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 or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 5. Maintain fire watch during and for at least four hours after flame-cutting operations.
 6. Maintain adequate ventilation when using cutting torches.
 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 10. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."
- B. Site Access and Temporary Controls: Conduct 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. Pack or crate items after cleaning. Identify contents of containers.

3. Store items in a secure area until delivery to Owner.
 4. Transport items to Owner's storage area designated by Owner.
 5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. 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.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.
- E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolition waste materials from Project site and recycle or dispose of them according to Section 01 7419 "Construction Waste Management and Disposal."
 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.
 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

3.8 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMWORK

PART 1 - GENERAL

1.1 Summary

- A. This Section includes but is not necessarily limited to the following:
 - 1. Furnish, install, and remove formwork, shoring and temporary structural supports for cast-in-place concrete.
 - 2. Furnish and install inserts, anchors and other embedded items.
- B. Related Sections:
 - 1. Section 03 20 00, Concrete Reinforcement.
 - 2. Section 03 30 00, Cast-in-Place Concrete.
 - 3. Section 03 35 00, Concrete Finishes.

1.2 References

- A. Published specifications, standards, test methods or other documents listed below are invoked where cited by abbreviations noted below. Latest editions of references apply unless a specific date or edition is listed.
 - 1. California Building Code (CBC), California Code of Regulations, Title 24, Part 2.
 - 2. American Concrete Institute (ACI):
 - a. ACI 117, "Tolerances for Concrete Construction and Materials."
 - b. ACI 301, "Specification for Structural Concrete for Buildings."
 - c. ACI 318, "Building Code Requirements for Structural Concrete."

1.2 Submittals

- A. Review of submittals is of a general nature only, and responsibility for conformance with intent of Drawings shall remain with the Contractor. Review does not imply or state that fabricator has correctly interpreted the construction documents.
- B. Submittal Protocol:
 - 1. Submit Shop Drawings per Division 01.
 - 2. Shop Drawing Coordination Notes: Clearly identify, by circling with a cloud and adding the note "Engineer Verify," the following:
 - a. Specific situations not addressed in the Construction Documents,
 - b. Proposed variations from the Construction Documents, or
 - c. Clarification requests (clearly note the nature of the question).
- C. Action Submittals:
 - 1. Formwork Shop Drawings to include:
 - a. Location and layout of all construction, crack control, and expansion joints shown in approved Concrete Joint Plan submittal described in Section 03 30 00, Cast-in-Place Concrete.
 - b. Location of formed edges, openings, depressions and penetrations shown in

- approved Penetration Plan submittal described in Section 03 30 00, Cast-in-Place Concrete.
- c. For exposed concrete surfaces, type and location of reveals, form joints, sleeves, finished surface textures, tie holes or plugs, embedded items and other features that will be exposed on the finish wall.
 2. Submit manufacturer's data for formwork release agent. Indicate the form surfaces where the formwork release agent will be used.

1.3 Quality Assurance

A. Formwork and Shoring Design:

1. Formwork, shoring, and reshoring design is the sole responsibility of the Contractor; resultant concrete to conform to required shape, line and dimensions.

1.4 Delivery, Storage and Handling

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use.

PART 2 - PRODUCTS

2.1 Materials

A. Forming Materials:

1. Formwork materials shall be appropriate for the specified finishes. Refer to Section 03 35 00, Concrete Finishes.
2. Chamfer Strips: Rigid PVC or wood, 3/4-inch by 3/4-inch size, maximum possible length. For each application use only one product.
3. Form Gaskets: Of sufficient thickness, widths and compressibility for specific use.

2.2 Form Hardware

- A. Use commercially manufactured formwork accessories. Do not use wire ties or wood spreaders.

- B. Form ties shall not leave open holes through concrete and shall permit neat and solid patching at every hole. At walls exposed to weather or water, form ties shall have integral water barrier plates in walls.

- C. For walls exposed to weather, earth or water:

1. Extruded fiberglass form ties, RJD Industries Supertie or approved equal, or
2. Metal ties with minimum breakback of 1-1/2 inches below concrete surface when forms are removed.

- D. For interior walls protected from the weather and water:

1. Extruded fiberglass form ties, or
2. Standard steel ties with minimum breakback of 3/4 inch below concrete surface when forms are removed.

- E. Use plastic cones or washers to completely cover holes in forms.

- F. Where wall is exposed to view in completed structure, use form ties with cones that leave a hole of not more than one inch in diameter on concrete surface.

2.3 Formwork Release Agents And Sealers

- A. Use commercially manufactured form release agents.
- B. Formwork release agents and sealers shall not harmfully affect appearance, discolor or change texture of finished concrete surface or inhibit proper application of any surface finishes, coatings or bonding agents.
- C. VOC content to comply with Air Quality Management District requirements.

PART 3 - EXECUTION

3.1 Examination

- A. Inspection:
 1. Inspect the installed Work of other trades and verify that such Work is completed to the point where this installation may properly commence.
 2. Verify that forms are constructed in accordance with all applicable codes and regulations, referenced standards, and Construction Documents.
- B. Discrepancies:
 1. In the event of discrepancy or conflict, immediately notify Architect and Structural Engineer.
 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 Construction of Forms

- A. Earth Forms: Unless otherwise required by Construction Documents, concrete that will remain in permanent contact with soil may be placed directly against vertical excavated surfaces provided the material will stand without caving or no sloughing of loose material. Make excavations as near as possible to neat lines required by the Drawings.
- B. Layout:
 1. Form concrete to shapes, sizes, lines, and dimensions indicated on the Drawings. Camber forms where camber is indicated.
 2. Make provision for openings, offsets, sleeves, recesses, anchorage, blocking, reglets, chases and other features of the Work as shown or required.
 3. Provide openings as necessary to place and consolidate concrete. Provide temporary holes in formwork to facilitate cleaning and inspection.
 4. See Drawings for patterns, textures, and reveals on concrete surfaces.
 5. Minimize, to a practical minimum, the number of seams on exposed or smooth surfaces.
 6. Form Ties for Exposed Surfaces: Locate as shown on Drawings. Unless otherwise indicated, arrange in a symmetrical regular pattern in level horizontal rows and plumbed vertically. Obtain prior approval from Architect for variations or changes in pattern from those shown on the Drawings.

7. Camber forms as shown on the plans. If camber is not shown, for spans greater than 30 feet in length, forms shall have a minimum camber at the center of the span of 1/80 inch times span length in feet. Camber shall approximate a smooth S-curve in elevation between the middle and both ends of the span.

8. Conform to requirements of ACI 301 Section 2.3.1.

C. Construction Joints:

1. Construction joints in exposed surfaces shall be located only at revealed form joint locations as indicated on the Drawings.

D. Tolerances:

1. Tolerances for formwork and embedded items shall be the most restrictive of:
 - a. Specified in ACI 117,
 - b. Specified in Section 03 35 00, Concrete Finishes,
 - c. As required for the installation of other items, and
 - d. As specified below.
2. Regardless of formed surface irregularity class specified, minimum section thickness shall not be less than that defined in ACI 117 for cross-sectional dimension tolerance, and clear cover over reinforcement shall not be less than that defined in ACI 117 for reinforcement location tolerance.

E. Construction:

1. Tape form joints for concrete exposed to view in the finished structure, including joints between form panels and trim strips.
2. Provide 3/4-inch chamfers in corners of formwork on permanently exposed surfaces. Do not chamfer re-entrant corners or top edges of beams and slabs.
3. Trowel rounded edge at top edges of beams and slabs, unless otherwise noted on the Drawings.
4. Form panel joints to be tight butt joints with edges true and square.
5. Do not install inside forms until reinforcement has been inspected.
6. For slabs on grade, verify top of subgrade is compatible with slab thickness shown.
7. Remove loose concrete, dust, and other material from existing concrete surfaces prior to erection of forms.

F. Finishes:

1. Provide as-cast surfaces as defined in Section 03 35 00, Concrete Finishes.

G. Form Release Agents:

1. Apply form release agent on formwork in accordance with manufacturer's recommendations.
2. Apply form release agents prior to placing reinforcement and embedded items.
3. Keep form release agents away from reinforcement, embedded items, and concrete against which fresh concrete will be placed.

3.3 Embedded Items

A. General:

1. Install anchorage devices, inserts, and other items embedded in cast-in-place concrete straight, level, plumb, and in accordance with manufacturer's recommendations:
 2. Secure anchor bolts and other embedded items in place during concrete placement.
 3. Fill voids in sleeves, inserts, and anchor slots with readily removable material to prevent entry of concrete into voids.
- B. Notify Architect and Structural Engineer whenever any embedded item interferes with placement of reinforcement or placement of concrete. Maintain concrete cover and spacing around embedments not less than that required for reinforcement.
 - C. Comply with ACI 301 Sections 2.3.1.12 and 2.3.1.13.
- 3.4 Preparation for Placement
- A. Clean and prepare existing concrete surfaces prior to installing forms.
 - B. Clean and inspect forms, embedded materials, and existing concrete surfaces immediately before placing concrete. Remove any material that will impair bond to reinforcement or concrete.
 - C. If bottoms of trenches become softened due to water before concrete is cast, repair as recommended by Geotechnical Engineer.
 - D. Hold formwork tight to previously placed concrete when placing subsequent pours at construction joints, to prevent fluid loss, mortar loss, and to maintain alignment of concrete surfaces.
 - E. Cover form clean-out openings and install removable sections of forms only after inspection of forms.

3.5 Shores and Removal of Forms

- A. Comply with ACI 301 Sections 2.3.2 through 2.3.5.
- B. Prior to installation of waterproofing or placement of backfill, remove formwork below ground surface on side to be waterproofed or backfilled.

3.6 Field Quality Assurance

- A. Geotechnical Engineer will inspect earthwork forms prior to placing of reinforcement.
- B. Owner's Testing Agency will, prior to pour, inspect:
 1. Existing concrete surfaces.
 2. Shape, location, and dimensions of forms.

END OF SECTION 03 10 00

SECTION 03 20 00

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 Summary

- A. This Section includes but is not necessarily limited to reinforcing for concrete.
- B. Related Sections:
 - 1. Section 03 10 00, Concrete Formwork.
 - 2. Section 03 25 00, Concrete and Masonry Anchors.
 - 3. Section 03 30 00, Cast-in-Place Concrete.

1.2 References

- A. Published specifications, standards, test methods, or other documents listed below are invoked where cited by abbreviations noted below. Latest editions of references apply unless a specific date or edition is listed.
 - 1. California Building Code (CBC), California Code of Regulations, Title 24, Part 2.
 - 2. American Concrete Institute (ACI):
 - a. ACI 117, "Tolerances for Concrete Construction and Materials."
 - b. ACI 301, "Specification for Structural Concrete for Buildings."
 - c. ACI 318, "Building Code Requirements for Reinforced Concrete."
 - 3. American Society for Testing and Materials (ASTM):
 - a. ASTM A29, "Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot Wrought."
 - b. ASTM A108, "Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished."
 - c. ASTM A123, "Standard Specification for Zinc Coatings."
 - d. ASTM A193, "Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications."
 - e. ASTM A563, "Standard Specification for Carbon and Alloy Steel Nuts."
 - f. ASTM A615, "Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement."
 - g. ASTM A706, "Standard Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement."
 - h. ASTM A722, Standard Specification for High-Strength Steel Bars for Prestressed Concrete."
 - i. ASTM A1064, "Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete."
 - 4. American Welding Society (AWS):
 - a. AWS D1.1, "Structural Welding Code – Steel."
 - b. AWS D1.4, "Structural Welding Code – Reinforcing Steel."
 - 5. Caltrans (California Department of Transportation)
 - a. Caltrans "Prequalification Procedures and Acceptance Criteria for Headed ASTM A706 Reinforcing Steel Bars."
 - 6. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice.

7. ICC Evaluation Service, Inc. (ICC-ES):
 - a. AC347, "Acceptance Criteria for Headed Ends of Concrete Reinforcement."
8. Research Council on Structural Connections (RSCS)
 - a. RSCS "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

1.3 Definitions

- A. Collector: a beam and/or strip of slab aligned with shear walls, and reinforcing in these beams and strips of slab running parallel to a shear wall. A collector may extend from the end of a shear wall, or may run alongside a shear wall and extend beyond the end of a shear wall.
- B. Evaluation Service Report (ESR): Product testing report from ICC Evaluation Service or equivalent from another approved agency.
- C. Seismic Load Resisting System (SLRS): shear walls, shear wall foundations and collectors.

1.4 Submittals

- A. Review of submittals is of a general nature only, and responsibility for conformance with intent of Drawings shall remain with the Contractor. Review does not imply or state that fabricator has correctly interpreted the construction documents.
- B. Submittal Protocol:
 1. Submit Shop Drawings per Division 01.
 2. Shop Drawing Coordination Notes: Clearly identify, by circling with a cloud and adding the note "Engineer Verify," the following:
 - a. Specific situations not addressed in the Construction Documents,
 - b. Proposed variations from the Construction Documents, or
 - c. Clarification requests (clearly note the nature of the question).
- C. Action Submittals:
 1. Shop Drawings:
 - a. Submit fully detailed shop drawings of concrete reinforcement for review prior to start of fabrication.
 - b. Show sizes and grades of steel, bending and splicing details, splice locations, accessories and concrete protection over steel reinforcement.
 - c. Shop drawings to include:
 - 1) Reinforcement placing drawings, bending schedules and bending diagrams showing size, dimensions, and location of reinforcing steel.
 - 2) Elevations of beams and walls.
 - 3) Details of areas of congestion. Identify where reinforcing steel will interfere with the placement of embedded items such as anchor rods, anchors, inserts, conduits, sleeves and any other items which are required to be cast in concrete.
 - 4) Supplemental reinforcement required at construction, crack control, and expansion joints shown in approved Concrete Joint Plan submittal described in Section 03 30 00, Cast-in-Place Concrete.
 - 5) Supplemental reinforcement required at edges, openings, depressions and penetrations shown in approved Penetration Plan submittal described in Section 03 30 00, Cast-in-Place Concrete.
 2. Direct copies of the contract documents are not acceptable as Contractor submittals.

D. Information-Only Submittals:

1. Mill Certificates: Submit steel producer's certificates of mill analysis, including steel source, description, heat number, yield point, ultimate tensile strength, elongation percent, bend test and the chemical composition of each heat as determined by ladle analysis, before delivery of steel to site.
2. Product Certifications:
 - a. Furnish mechanical coupler and deformed bar anchor manufacturers' certifications that products comply with specified ESR.

1.5 Quality Assurance

A. Owner's Testing Agency:

1. Field inspection of reinforcing shall be performed by an independent laboratory ("Testing Agency") engaged by the Owner. If required, shop testing and inspection shall also be performed by the Testing Agency.

1.6 Delivery, Storage and Handling

- A. Delivery: Deliver reinforcement to jobsite bundled, tagged and marked. Use tags that indicate bar size, grade, lengths and marks corresponding to markings shown on shop drawings.
- B. Reinforcement shall be stored clear of the ground in piles according to size, in a manner to prevent bending, rusting or accumulation of dirt or oil.
- C. Use all necessary care to maintain identification of reinforcing after bundles are broken apart.

PART 2 - PRODUCTS

2.1 Materials

- A. Reinforcing Bars:
 1. ASTM A615, Grade 60, except as otherwise noted.
 2. ASTM A706 for members of the Seismic Load Resisting System (SLRS).
- B. Plain Wire: ASTM A 1064
- C. Deformed Wire: ASTM A 1064
- D. Welded Wire Fabric (WWF) Reinforcement:
 1. Plain and deformed wire reinforcement: ASTM A1064.
 2. Where placed in concrete exposed to weather or potentially exposed to interior water (shower areas, etc), galvanize per ASTM A123.
- E. Spiral Reinforcement: ASTM A1064 if specified as wire, or ASTM A706 or ASTM A615, Grade 60, if specified by bar size.
- F. Accessories:
 1. Metal or plastic spacers, supports, ties, precast concrete blocks, etc., as required for spacing, assembling and supporting reinforcing in place. Supports of wood, clay or

brick are not allowed.

2. Use stainless steel, plastic or CRSI Class 1 wire supports where contact surface is exposed to weather or dampness, or where epoxy-coated reinforcing is used.

G. Anchor Bolts and Anchor Rods:

1. See the Structural Notes on the Structural Drawings for anchor bolt materials.
2. Nuts:
 - a. Heavy hex.
 - b. As recommended by ASTM specification for corresponding anchor rod or bolt.
 - c. For A449, F1554 Grade 105, or A193 Grade B7:
 - 1) Nuts of material A563 Grade A shall NOT be used.
 - 2) Use A563 Grade C, C3, D, DH or DH3 nuts, as appropriate for specific application. If hot-dip galvanized, use only Grade DH.
3. Washers:
 - a. As recommended by ASTM specification for corresponding anchor rod or bolt.
 - b. For oversize and slotted holes in steel material, see washer provisions of Research Council on Structural Connections (RCSC) "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
 - c. For wood sill anchor bolts in shear walls, provide 1/4-inch (0.229" min.) thick by 3-inch square steel plate washers for 4x nominal (3.5" wide) bottom plates, and 3" x 5" steel plate washers for 6x nominal (5.5" wide) bottom plates. Plate washer shall extend to within 1/2" of edge of bottom plate on side(s) with sheathing. If washer holes are slotted, comply with CBC Section 2308.3.1.
4. Couplers shall match or exceed strength of rods they connect.

H. Mechanical Couplers:

1. Type 2 mechanical couplers in accordance with the provisions of ACI 318 Section 18.2.7.1.
2. In addition, provide test reports to failure, demonstrating that no observed partial or total fracture of the coupler or the coupler-bar connection occur; the failure shall be observed to occur in the parent reinforcing bar material a minimum of one bar diameter from the coupler connection. Failure of the head or the head-to-bar connection within the attachment region is unacceptable and shall be cause for rejection.
3. Acceptable Products:
 - a. HRC Couplers conforming to ICC-ES Report No. ER-5309,
 - b. Dextra Bartec Mechanical Splice System conforming to ICC-ES Report No. ESR-1705,
 - c. Bar-Lock L-series Couplers conforming to ICC-ES Report No. ESR-2495, but only where diameter and length of coupler can fit between transverse reinforcing without displacing the transverse or longitudinal reinforcing
 - d. BarSplice Grip Twist Type 2 Mechanical Flanged Coupler conforming to ICC-ES Report No. ESR-2299, or
 - e. Equal or better approved substitution.
4. Form-saver couplers shall meet Mechanical Couplers requirements 1 and 2.

I. Headed Shear Connector Studs (Nelson S3L and similar)

1. AWS D1.1 Type B Studs
 - a. 51 ksi minimum yield, F_y

- b. 65 ksi minimum tensile strength, F_u
- 2. Manufacturer, ICC ES evaluation report and ASTM specification:
 - a. Nelson Stud Welding Division of TRW
 - 1) Conforms to ESR-2856
 - 2) ASTM A29-12, Grades 1010 through 1020, cold-drawn steel
 - b. Stud Welding Associates, Strongsville, Ohio
 - 1) Conforms to ICC-ES Report No. 1094
 - 2) ASTM A108 Grades C-1010 through C-1020, cold drawn steel
 - c. Equal or better approved substitution
- J. Deformed Bar Anchors (Nelson D2L and similar):
 - 1. ASTM A496 or A1064
 - a. 70 ksi minimum yield, F_y
 - b. 80 ksi minimum tensile strength, F_u
 - 2. Manufacturer and ICC-ES report:
 - a. Nelson Stud Welding Division of TRW:
 - 1) Conforms to ESR-2856
 - b. Stud Welding Associates, Strongsville, Ohio
 - 1) Conforms to ER-4601 (legacy report)
 - c. Equal or better approved substitution.

2.2 Fabrication

- A. Conform to requirements of ACI 318 Chapter 25, except lap bar splices as indicated on the drawings. Refer to structural details for bar sizes, number of bars, and placing details.
- B. Fabricate reinforcing bars in accordance with the tolerances of ACI 117 and ACI 318 Section 26.6.2 unless noted otherwise.
- C. Bending:
 - 1. Minimum bend diameters and hook extensions as shown on the drawings.
 - 2. Reinforcing bars are to be bent cold unless heating is permitted.
 - 3. Do not bend or kink reinforcing except as shown on the Drawings.
- D. Shop fabricated fusion-welded assemblies (such as “Idea Machine” rebar cages) are acceptable provided:
 - 1. Reinforcing bars: ASTM A706.
 - 2. Holding wires: ASTM A1064.
 - 3. Welding process in accordance with ASTM A1064.
- E. Spirals: Provide a minimum of 1-1/2 finishing turns top and bottom.
- F. Install mechanical couplers and headed bars in accordance with manufacturer's recommendations and ESR.
- G. Headed Shear Connector Studs (Nelson S3L and similar) and deformed bar anchors (Nelson D2L and similar):
 - 1. Install headed studs and deformed bar anchors with stud welding gun to achieve full fusion arc weld in accordance with the manufacturer's recommendations and the requirements of AWS D1.1.

2. Deformed Bar Anchors: Detailing of bends, hooks, etc., to comply with requirements for reinforcing bars.
- H. Ends of Bars: all reinforcing ending at wall and slab edges, and at the ends of beams, shall terminate with hooks (90, 135 or 180 degree), T-heads (T1 or T2), or shall lap splice with U-bar end caps or with dowels fastened into existing adjacent concrete or structural steel.

2.3 Shop Quality Assurance

- A. Testing and inspection of shop-fabricated components or assemblies will be the same as specified for field quality assurance in Part 3.
- B. Identify reinforcing and verify reinforcement is of type and grade specified.

PART 3 - EXECUTION

3.1 Installation

- A. General:
 1. Inspect all excavations in accordance with Earthwork specifications prior to placing reinforcement.
 2. Wherever embedded items interfere with placement of reinforcement, notify Architect and Structural Engineer and obtain written approval before placing any concrete.
- B. Placing:
 1. Do not exceed the tolerances defined in ACI 117 or ACI 318 Section 26.6.2.
 2. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations.
 3. Use templates for placement of column dowels.
 4. Do not place reinforcement in floor slabs or beams until concrete has been placed in columns and walls where the reinforcing will restrict the placement of concrete.
 5. Dowels shall be tied securely in place before concrete is deposited.
 6. Do not install kinked, bent or misplaced reinforcing.
 7. The uppermost and lower most horizontal reinforcement for concrete walls shall be placed within one half of the specified spacing at the top and bottom of the wall and at all construction joints.
 8. Continue reinforcement across construction joints at least equal to lap development lengths on either side of the joint unless otherwise detailed.
 9. Terminate all reinforcing that ends at wall and slab edges, and at the ends of beams, per the "Ends of Bars" article in the Fabrication sub-part of Part 2 of this specification.
- C. Installation of Welded Wire Fabric (WWF) Reinforcement: Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces a minimum of one full mesh space plus 3 inches, unless otherwise noted on the structural drawings. Offset the short side laps of adjoining pieces so that no more than three layers of fabric overlap at any overlap location.
- D. Field Bending:
 1. Field bending or straightening in accordance with ACI 301 Section 3.3.2.8.
 2. Do not re-bend reinforcement that has previously been bent within 6 inches of new

bend except as shown on the Drawings or explicitly allowed by the Architect and Structural Engineer.

- E. Spacing of Reinforcing: Where Drawings do not show the spacing of the reinforcing, provide minimum clear spacing conforming to ACI 318 Section 25.2 nor less than 4/3 times the maximum size aggregate.
- F. As a minimum provide the concrete cover shown on the drawings.
- G. Splicing:
 - 1. Make splices only at those locations shown on the Drawings or as accepted by the Architect and Structural Engineer.
 - 2. Stagger splices in adjacent bars wherever possible.
 - 3. Lap splice lengths as per Typical Lap Splice detail unless otherwise shown.
- H. Reinforcing Supports:
 - 1. Suitable metal or plastic devices of some standard manufacture shall be used to hold reinforcement in its true horizontal and vertical positions. These devices shall be sufficiently rigid and numerous to prevent displacement of the reinforcement during placement of concrete. All such devices shall have prior approval from the Architect.
 - 2. Support reinforcement supported on the ground on precast concrete units or other non-corrosive supports.
 - 3. On surfaces of walls to be sandblasted or where exposed to view in the final structure use stainless steel supporting chairs, spacers, or bolsters. Plastic chairs, spacers and bolsters may be used where walls are exposed to view but not sandblasted, with the prior approval of the Architect.
 - 4. Where concrete is exposed to the elements or where the underside of slabs or beams is exposed to view in the completed structure, use plastic or stainless steel supports.
 - 5. Do not use wood, brick, stone or other similar materials to support reinforcing.
 - 6. Do not use reinforcing supports or reinforcing to support concrete conveying equipment and similar construction loads.
- I. Tying:
 - 1. Reinforcing shall be rigidly and securely tied. Tie wires, after cutting, shall be bent away from exposed concrete surfaces and so that concrete placement will not force the wire ends to surface of exposed concrete.
 - 2. Reinforcing in concrete members that have one or more surfaces exposed to weather (with or without a painted finish) shall be tied with galvanized wire.
- J. Anchor Bolts and Rods:
 - 1. Supervise setting of anchor bolts required for wood framing and anchor rods required for erection of structural steel. Ensure correct installation and location of anchor bolts and rods.
 - 2. Anchor bolts and rods must be securely held in place and aligned in a true straight line prior to and during concrete placement.
 - 3. Anchor bolts and rods may not be “wet set,” i.e., pushed into wet concrete.
- K. Embedded Items:

1. Secure embedded items to prevent displacement during placement of concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached.
2. Aluminum embedments (including aluminum conduit) in direct contact with concrete are not allowed.
3. Utilities: The location and protection of existing utilities is the responsibility of the Contractor. Notify Structural Engineer if utility pipes run through, or within 24 inches below, any new concrete construction. If the condition is not covered by details in the drawings, the Structural Engineer will provide the Contractor with design details under such circumstances.
4. Soil-Concrete Interface: Buried pipes or conduits in soil entering subgrade concrete (foundations, basement walls, retaining walls, slabs-on-grade, mat slabs, etc.) shall, within the concrete, be wrapped with compressible material (e.g. polyurethane foam), at least 3/4 inch thick. Alternatively, install pipe within a plastic pipe sleeve with an annular gap between inside of sleeve and outside of pipe of no less than 3/4 inch and no more than 1-1/4 inch, unless otherwise noted in the drawings. Wrap or sleeve shall extend at least 18 pipe diameters into the concrete unless otherwise noted on the drawings. Outside face of wrap or sleeve shall be at least one inch clear of all reinforcing.
5. Pipes and conduits:
 - a. Shall be at least 1 inch clear of adjacent reinforcing.
 - b. Place pipes and conduits no closer than two slab depths from columns, walls, drop panels or stud rails, unless specifically shown on structural drawings.
 - c. Provide pipe sleeves where pipes pass through concrete before pour.
 - d. Comply with ACI 318 Section 26.8.
6. Pipes and plastic or steel electrical conduits running horizontally in slabs (both slabs-on-grade and elevated slabs) may be embedded in slabs provided that the following criteria are met:
 - a. Diameter limits: The outside diameter does not exceed one quarter of the slab thickness, nor 1-1/2 inches.
 - b. Location in slab depth: Pipes and conduits shall be located within the middle third of the slab thickness, and located at least 1.5 inches clear of all reinforcing running parallel to, or within 45 degrees of, the pipe or conduit.
 - c. Distance from columns and walls: Pipes and conduits in elevated slabs shall be located at least five slab thicknesses away from columns; pipes and conduits running parallel or within 45 degrees to walls shall be located at least four slab thicknesses away from the wall. Pipes or conduits embedded in the mat slab shall be located at least two slab depths away from columns that support braced frames above, and at least one slab depth away from perimeter retaining walls.
 - d. Clear spacing: The clear spacing between the pipes or conduits is not less than three (3) times the diameter of the largest pipe or conduit.
 - e. Precedence: Location of reinforcing takes precedence over location of conduits. Conduits shall not interfere with, displace or offset reinforcing or post-tensioning tendons.
 - f. Cross-overs: Where pipes and/or conduits cross over each other, they shall remain within the middle third of the slab. Pipes and conduits shall cross over each other at right angles +/- 30 degrees. Only one cross-over layer is allowed at any location in plan.
 - g. Dense arrays of conduit: Conduit entering the slab from one location (e.g. at electrical rooms), spaced closer than three clear diameters apart, is not allowed. At such locations, conduit shall run below the slab until the conduit spreads far enough apart that it meets the three clear diameters spacing

- requirement before entering the slab.
- h. Anchor bolts: Conduits or pipes in slabs shall be located at least 12 inches or at least one embedment depth (whichever is more) from anchor bolts, anchor rods, stud rails, tendon anchorages or hold-downs, where embedment depth refers to the anchor bolts, rods, rails, anchorages or hold-downs.
7. Conduits or pipes in walls:
- a. 3/4 inch diameter or less and spaced at least 18 inches apart.
- b. Place conduits and pipes in middle third of wall.
- c. Not allowed within two feet of end of wall.
8. Conduits and pipes in columns:
- a. Not allowed.
9. Conduits and pipes in beams:
- a. Only allowed in locations shown on the drawings, or where specifically approved by the Engineer.
- L. Notify Architect and Structural Engineer whenever any embedded item interferes with placement of reinforcement or placement of concrete. Maintain the same concrete cover and spacing around embedments as that required for reinforcement.
- M. Install deformed bar anchors in accordance with manufacturer's recommendations.
- N. Install mechanical couplers and headed bars in accordance with manufacturer's recommendations. Install mechanical couplers only at locations shown on the drawings.
- O. Install other manufactured products listed in Part 2 of this specification according to manufacturers' recommendations.
- P. Cleaning:
1. Clean reinforcement to remove earth, ice, oil, grease and other materials that will destroy or reduce bond between steel and concrete.
2. Rust and mill scale that is "tight" to the bar is allowed to remain. Rust that is flaky or easily removed, such as by dropping or striking with a hammer, indicates excessive rust. Such bars shall:
- a. Be cleaned of rust, and
- b. Not to be used unless found to comply with ACI 318 Section 26.6.1.2(b).
3. Where there is a potential of rust staining adjacent finish surfaces, take necessary steps to prevent staining.

3.2 Field Quality Assurance

- A. Notify Owner's Testing Agency, Architect and Structural Engineer at least two business days before concrete is to be poured or reinforcing is covered up. Allow sufficient time to perform any corrective actions prior to concrete pour.
- B. Owner's Testing Agency will:
1. Inspect reinforcing for conformance with the following ACI 318 Sections:
- a. Concrete Cover: 20.6.1
- b. Spacing for Reinforcement: 25.2
- c. Standard Hooks & Bend Diameter: 25.3
- d. Bundled Bars: 25.6
- e. Surface Conditions: 26.6.1
- f. Placing Reinforcement: 26.6.2

- g. Bending: 26.6.3
2. Verify that anchor bolts, anchor rods and other embedded items are held firmly in position prior to placing concrete.
 3. Provide continuous inspection during any field bending of reinforcement.
 4. Inspect re-bent bars for signs of cracking or fracture.
 5. Inspect installation of headed shear connector studs (Nelson S3L studs and similar) and deformed bar anchors (Nelson D2L bars and similar) in accordance with Section 7.1 of AWS D1.1 and corresponding ESR.
 6. Inspect mechanical coupler installation in accordance with corresponding ESR.
- C. Correct all errors and discrepancies prior to concrete placement.

END OF SECTION 03 20 00

SECTION 03 25 00

CONCRETE AND MASONRY ANCHORS

PART 1 - GENERAL

1.1 Summary

- A. This Section includes but is not necessarily limited to concrete and masonry anchors shown on the structural or architectural drawings and installed after concrete or masonry is placed.
- B. Where structural drawings show cast-in-place embedded anchors, post-installed concrete and masonry anchors shall not be substituted without prior approval of Structural Engineer. Heavily loaded embedded anchors, such as shear wall, braced frame and moment frame tie-down rod anchorages, usually do not have an acceptable post-installed equivalent anchor. If such cast-in-place anchors are omitted, remedial action is likely to be removal, repair and recasting of concrete.
- C. See Mechanical, Fire Suppression, Plumbing and Electrical Divisions for concrete and masonry anchors for utilities and equipment. Concrete and masonry anchors for all Divisions shall meet seismic requirements for cracked concrete where such conditions apply, and shall have supporting Evaluation Service Reports.
- D. Related Sections:
 - 1. Division 03 Concrete Sections.
 - 2. Division 04 Masonry Sections.
 - 3. Division 05 Metals Sections.
 - 4. Division 21 Fire Suppression, Division 22 Plumbing, Division 23 HVAC and Division 26 Electrical Sections.

1.2 References

- A. Published specifications, standards, test methods or other documents listed below are invoked where cited by abbreviations noted below. Latest editions of references apply unless a specific date or edition is listed.
 - 1. California Building Code (CBC), California Code of Regulations, Title 24, Part 2.
 - 2. American Concrete Institute (ACI):
 - a. ACI 318, "Building Code Requirements for Structural Concrete."
 - 3. American National Standards Institute (ANSI):
 - a. ANSI B212.15, "Carbide-Tipped Masonry Drills & Blanks for Carbide-Tipped Masonry Drills."

1.3 Definitions

- A. CMU: Concrete Masonry Unit.
- B. Evaluation Service Report (ESR): Product evaluation report issued by ICC Evaluation Service, IAPMO, or equivalent from another approved agency.

1.4 Submittals

- A. Review of submittals is of a general nature only, and the responsibility for conformance with

intent of drawings shall remain with the Contractor. Review does not imply or state that the fabricator has correctly interpreted the construction documents.

B. Submittal Protocol:

1. Submit shop drawings and product data per Division 01.
2. Shop Drawing Coordination Notes: Clearly identify, by circling with a cloud and adding the note "Engineer Verify," the following:
 - a. Specific situations not addressed in the Construction Documents,
 - b. Proposed variations from the Construction Documents, or
 - c. Clarification requests (clearly note the nature of the question).

C. Action Submittals:

1. Submit product data including ESR for each anchor product proposed for use.

D. Substitution Requests: If one product is specifically called out in the drawings, and a substitution request is proposed, submit substitution request in accordance with Division 01 requirements and containing the following:

1. Original product and proposed substitution.
2. Location and quantity of anchors and drawing detail where anchor is called out.
3. Comparison of ESRs for original product and proposed substitution, circling or highlighting the following:
 - a. Tension and shear values at equivalent embedment depths and edge distances that occur on the project,
 - b. Minimum edge distances, with actual minimum distances occurring in the project noted alongside.
4. Only anchor products listed in this specification may be proposed as a substitution for anchors called for on the drawings.
5. Expansion anchors may not be proposed as a substitution for undercut, screw-in or epoxy-grouted anchors.
6. Do not install proposed substitution unless and until after substitution request is approved.

PART 2 - PRODUCTS

2.1 Epoxy-Grouted Dowels

- A. Not allowed for permanent gravity-loaded connections, loaded in either shear or tension.
- B. For anchoring reinforcing steel or threaded dowels in concrete:
 1. Simpson SET-XP, in accordance with ICC-ES Report No. ESR-2508 (design basis).
 2. Hilti RE 500-V3, in accordance with ICC-ES Report No. ESR-3814 (substitution request required).
 3. Powers PE1000+, in accordance with ICC-ES Report No. ESR-2583 (substitution request required).
- C. For anchoring reinforcing steel or threaded dowels in solid-grouted CMU:
 1. Simpson SET Epoxy, in accordance with ICC-ES Report No. ESR-1772 (design basis).

2. Simpson SET Epoxy, in accordance with ICC-ES Report No. ESR-1772 (substitution request required).

D. Dowels:

1. As called for in the drawings, or
2. For dowels not specified in the drawings, see Part 3 of this Section.

2.2 Mechanical Anchors

A. Expansion Anchors in Concrete:

1. Simpson Strong-Bolt 2, in accordance with ICC-ES Report No. ESR-3037 (design basis).
2. Hilti Kwik Bolt TZ, in accordance with ICC-ES Report No. ESR-1917 (substitution request required).
3. DeWalt/Powers Power-Stud+SD2, in accordance with ICC-ES Report No. ESR-2502 (substitution request required).

B. Expansion Anchors in CMU:

1. Simpson Wedge-All, in accordance with ICC-ES Report No. ESR-1396 (design basis).
2. Hilti Kwik Bolt 3, in accordance with ICC-ES Report No. ESR-1385 (substitution request required).

C. Screw-In Anchors in Concrete or CMU:

1. Simpson Titen HD Anchor, in accordance with ICC-ES Report No. ESR-2713 (design basis).
2. Hilti Kwik HUS-EZ, in accordance with ICC-ES Report No. ESR-3027 (substitution request required).
3. DeWalt/Powers Screw-Bolt+ in accordance with ICC-ES Report No. ESR 3889 (substitution request required).
4. Called out as "SCREW-IN ANCHOR" on the drawings,
5. Diameter and embedment length as called out on the drawings. If embedment length is not specified, provide longest minimum embedment length listed in ESR unless other physical limits are encountered, in which case use shortest minimum embedment length listed in the ESR.

D. Concrete/Masonry Screws:

1. Products:
 - a. Simpson Titen Concrete and Masonry Screw (design basis).
 - b. Simpson Titen Concrete and Masonry Screw (design basis).
2. Called out as "CONCRETE SCREW" on the drawings.
3. Unless otherwise noted on the drawings, 1/4-inch diameter screw with 1-3/4-inch minimum embedment into concrete or masonry.
4. Phillips flat tapered head if fastened to wood, pan hex head if fastened to steel.

2.3 Corrosion Provisions (applies to all fasteners and anchors):

A. Medium Corrosive Environment:

1. Exposed to weather, and
 - a. Not within 200 yards of the ocean, and
 - b. Not in contact with pressure-treated wood other than SBX-DOT Zinc Borate:
2. Allowed fastener materials and/or coatings:
 - a. Stainless Steel,
 - 1) Type 410 with protective top coat
 - 2) Type 304, 305, 316 or 316L.
 - b. Hot-dip Galvanized (ASTM A153- Class D),
 - c. Mechanically Galvanized (ASTM B695-Class 55),
 - d. Proprietary organic coatings allowed for wet use, such as:
 - 1) Quik Guard (Simpson)
 - 2) ZMAX (G185) (Simpson)

B. High or Severe Corrosive Environment:

1. Dry Conditions:
 - a. In contact with pressure-treated wood other than SBX-DOT Zinc Borate,
2. Wet Conditions (exposed to weather):
 - a. In contact with pressure-treated wood other than SBX-DOT Zinc Borate,
 - b. In contact with seawater, or
 - c. Within 200 yards of the ocean.
3. Allowed fastener materials and/or coatings:
 - a. Stainless Steel,
 - 1) 316L
 - 2) 304 or 305 is allowed only if not within 200 yards of the ocean and wood treatment is
 - a) Fire Resistance Treatment
 - b) ACZA ,or
 - c) AWPA chemical retention is equal to or less than AWPA UC4A
 - b. Hot-dip Galvanized (ASTM A153- Class C)

PART 3 - EXECUTION

3.1 General

- A. Before drilling, locate all embedded items, including reinforcing, post-tensioning tendons, conduits, and plumbing. Locate items by non-destructive methods such as survey before casting, pachometer survey, or ground-penetrating radar survey. Exploratory chipping is only allowed where concrete surface will be concealed. Patch chipped areas. Clearly mark all embedded items in a manner that will not stain or permanently mark visually exposed concrete.
- B. Control drilling or coring operations to avoid cutting or damaging embedded items. Immediately report any violations to Project Inspector, Architect and Structural Engineer.

3.2 Installation

A. Epoxy-Grouted Dowels:

1. Overhead applications are not allowed.
2. Periodic Special Inspection shall be provided unless noted otherwise on the drawings.
3. Drill holes 1/8 inch larger than diameter of embedded rod or reinforcing, unless

otherwise noted by manufacturer or applicable ESR. Use carbide-tipped drill bits. Rotary-hammer drills with light, high-frequency impact are recommended for drilling holes in reinforced concrete and solid-grouted CMU.

4. Remove dust from hole with oil-free compressed air for a minimum of 4 seconds.
5. Clean with a nylon brush for a minimum of 4 cycles.
6. Remove dust a second time with oil-free compressed air for a minimum of 4 seconds.
7. Hole shall be dry before inserting epoxy.
8. Concrete or CMU temperature shall be above minimum application temperature specified by manufacturer.
9. Use proprietary mixing nozzle applicable to particular epoxy product, and dispense initial shot of epoxy in waste container until properly mixed, as indicated by uniform color.
10. Fill hole one-half to two-thirds full, starting from bottom of hole, to prevent air pockets. Withdraw nozzle as hole fills up.
11. Insert clean, oil-free anchor, turning slowly until anchor contacts bottom of hole.
12. Remove excess epoxy from concrete surface around hole before it hardens.
13. Do not disturb, bolt up, or apply load to the anchor until the epoxy is fully cured (see manufacturer's instructions for recommended minimum cure time).
14. Location and extent of epoxy-grouted dowels:
 - a. As shown on the structural drawings, and in addition as follows:
 - b. All contact surfaces between new concrete or shotcrete and existing concrete or masonry, or between new block masonry and existing masonry or concrete, shall be connected by epoxy-grouted dowels. If dowels are not shown on the drawings for typical or similar conditions, then dowels shall be no less than the following:
 - 1) New concrete or shotcrete columns, pilasters, or walls in contact with new concrete masonry units: #5 hooked or long straight dowels at 16 inches on center (vertical dimension).
 - 2) New CMU in contact with existing concrete: #5 hooked or long straight dowels at 16 inches on center (vertical dimension).
 - c. Exception: all contact areas that indicate a dimensioned gap, seismic joint, or compressible material at the interface shall not be dowelled.

B. Mechanical Anchors

1. Drill holes to manufacturer's specified diameter with carbide-tipped bits meeting diameter requirements of ANSI B212.15. Rotary-hammer drills with light, high-frequency impact are recommended for drilling holes in reinforced concrete or solid-grouted CMU.
2. Follow manufacturer's installation instructions. Torque bolts per manufacturer's recommendations or requirements of applicable ESR.
3. Threaded end of bolt shall extend not less than flush with outside face of nut, and where exposed to view in the final structure, shall not extend more than 1/4 inch beyond outside face of nut, unless otherwise shown on the drawings.
4. Mechanical anchors shall be covered by spray-on fireproofing or otherwise protected from fire as required by the Architect.

3.3 Field Quality Assurance

A. Owner's Testing Agency will:

1. Observe installation of reinforcing steel or threaded rods in grouted holes and then proof test per the Structural Notes in the drawings.
2. Perform inspections and tests in accordance with recommendations of ESR for anchor product. Special inspection shall be periodic unless noted otherwise on the drawings.

B. Epoxy-Grouted Dowels in Concrete:

1. Owner's Testing Agency will inspect and test as follows:
 - a. At onset of installation, verify adhesive identification and expiration date, hole dimensions, hole cleaning procedures, hole spacing and edge distances, concrete thickness, and dowel type, grade and size.
 - b. Continuous inspection not required for remainder subsequent installations of the same anchor by the same crew if installation takes less than a week; otherwise periodic inspection once a week is required.|Continuous inspection is required.
2. Quality Control Pull Tests:
 - a. Purpose of pull tests is to check epoxy bond to concrete, not concrete shear cone failure. Therefore the testing apparatus is allowed to react (push) against the concrete adjacent the dowel.
 - b. After sufficient cure time, pull test epoxy-grouted threaded rod or reinforcing bars to the following loads:
 - 1) 3/8" rod or #3 bar: 3,000 lbs.
 - 2) 1/2" rod or #4 bar: 5,400 lbs.
 - 3) 5/8" rod or #5 bar: 8,400 lbs.
 - 4) 3/4" rod or #6 bar: 11,900 lbs.
 - 5) 7/8" rod or #7 bar: 16,200 lbs.
 - 6) 1" rod or #8 bar: 21,300 lbs.
 - 7) 1-1/8" rod or #9 bar: 27,000 lbs.
 - c. Test frequency and pass criteria:
 - 1) Test 10% of all dowels:
 - a) pass criteria: 100% pass.
 - 2) If not, test 25% of all dowels (i.e. test additional 15%):
 - a) Pass criteria: 95% pass, replace and retest dowels that do not pass.
 - 3) If not, test 100% of dowels, replace and retest dowels that do not pass.

3.4 Cleaning

- A. Upon completion and acceptance of testing, remove test dowels unless directed otherwise by Architect or Owner:
 1. Where test dowel locations will be concealed in completed structure, cut off test dowels flush with surrounding surface.
 2. Where test dowel locations will remain exposed to view in completed structure, cut off test dowels a sufficient depth below surrounding surface in order to accommodate patching as directed by Architect.
- B. Upon completion of grouted anchor installation, remove and properly dispose of excess grout.

END OF SECTION 03 25 00

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 Summary

- A. This Section includes cast-in-place concrete as shown and specified, and as required for a complete and proper installation, including but not limited to:
 - 1. Foundations.
 - 2. Concrete slabs on grade.
 - 3. Equipment pads and curbs.
- B. Related Sections:
 - 1. Section 03 10 00, Concrete Formwork.
 - 2. Section 03 20 00, Concrete Reinforcement.
 - 3. Section 03 25 00, Concrete and Masonry Anchors.
 - 4. Section 03 35 00, Concrete Finishes.

1.2 References

- A. Published specifications, standards, test methods or other documents listed below are invoked where cited by abbreviations noted below. Latest editions of references apply unless a specific date or edition is listed.
 - 1. California Building Code (CBC), California Code of Regulations, Title 24, Part 2.
 - 2. American Concrete Institute (ACI):
 - a. ACI 117, "Standard Tolerances for Concrete Construction and Materials."
 - b. ACI 211.4R, "Guide for Selecting Proportions for High-Strength Concrete Using Portland Cement and Other Cementitious Materials."
 - c. ACI 301, "Specification for Structural Concrete for Buildings."
 - d. ACI 302.1R, "Guide for Concrete Floor and Slab Construction."
 - e. ACI 305.1, "Specification for Hot Weather Concreting."
 - f. ACI 306.1, "Standard Specification for Cold Weather Concreting."
 - g. ACI 308.1, "Standard Specification for Curing Concrete."
 - h. ACI 318, "Building Code Requirements for Structural Concrete."
 - 3. American Society for Testing and Materials (ASTM):
 - a. ASTM C10, "Standard Specification for Natural Cement."
 - b. ASTM C33, "Standard Specification for Concrete Aggregates."
 - c. ASTM C39, "Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens."
 - d. ASTM C94, "Standard Specification for Ready-Mixed Concrete."
 - e. ASTM C150, "Standard Specification for Portland Cement."
 - f. ASTM C171, "Standard Specification for Sheet Materials for Curing Concrete."
 - g. ASTM C260, "Standard Specification for Air-Entraining Admixtures for Concrete."
 - h. ASTM C289, "Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)."
 - i. ASTM C309, "Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete."

- j. ASTM C330, "Standard Specification for Lightweight Concrete Aggregate for Structural Concrete."
- k. ASTM C494, "Standard Specifications for Chemical Admixtures of Concrete."
- l. ASTM C595, "Standard Specification for Blended Hydraulic Cements."
- m. ASTM C618, "Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete."
- n. ASTM C 827, "Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures."
- o. ASTM C881, "Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete."
- p. ASTM C989, "Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars."
- q. ASTM C1017, "Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete."
- r. ASTM C1107, "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink)."
- s. ASTM C1157, "Standard Performance Specification for Hydraulic Cement."
- t. ASTM 1240, "Standard Specification for Silica Fume Used in Cementitious Mixtures."
- u. ASTM C1293, "Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction"
- v. ASTM C1608, "Standard Test Method for Chemical Shrinkage of Hydraulic Cement Paste."
- w. ASTM C1610, "Standard Test Method for Static Segregation of Self-Consolidating Concrete Using Column Technique."
- x. ASTM C1611, "Standard Test Method for Slump Flow of Self-Consolidating Concrete."
- y. ASTM C1621, "Standard Test Method for Passing Ability of Self-Consolidating Concrete by J-Ring."
- z. ASTM E1155, "Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers."
- aa. ASTM E1745, "Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs."

1.3 Definitions

- A. Maximum Aggregate Size: Largest aggregate in a concrete mix. Note: Maximum Aggregate Size is defined on the Structural Notes on the Drawings. The Maximum Aggregate Size is often given as a range, such as 1/2" to 1". In this example, a concrete design with a maximum aggregate size as small as 1/2" is acceptable. In this example, mixes with a maximum aggregate size of 3/4" or 1" are also acceptable.
- B. Supplementary Cementitious Materials (SCM): Cementitious materials other than Portland cement, such as coal fly ash, blast-furnace slag and/or natural pozzolans.
- C. Total Cementitious Materials: All cementitious materials, i.e., Portland cement plus SCM.
- D. Well-graded: concrete mix that contains a range of intermediate aggregate sizes between sand and the maximum aggregate size.
- E. Highly Flowing Concrete: concrete mix design with a target slump greater than 7 inches.
- F. Self-Consolidating Concrete: concrete mix design with a target slump greater than 10 inches.

1.4 Submittals

- A. Review of submittals is of a general nature only, and the responsibility for conformance with intent of drawings shall remain with the Contractor. Review does not imply or state that the fabricator has correctly interpreted the construction documents.
- B. Submittal Protocol:
 - 1. Submit Shop Drawings per Division 01.
 - 2. Shop Drawing Coordination Notes: Clearly identify, by circling with a cloud and adding the note "Engineer Verify," the following:
 - a. Specific situations not addressed in the Construction Documents,
 - b. Proposed variations from the Construction Documents, or
 - c. Clarification requests (clearly note the nature of the question).
- C. Action Submittals:
 - 1. Concrete Mix Designs: Submit mix design documentation for each class of concrete prepared in accordance with ACI 318 Section 26.4.
 - a. The Owner's Testing Agency will review and approve.
 - b. As a minimum, mix designs to include the following:
 - 1) All materials and admixtures and their proportions.
 - 2) Water and cement content, water-cementitious material ratio, target slump, and combined aggregate gradation (percent retained on every sieve size).
 - 3) Target slump and tolerance if different from that specified in ASTM C94.
 - 4) Information on concrete materials per ACI 301 Section 4.1.2.3.
 - 5) Evidence that aggregate is not alkali reactive per ASTM C33 Appendix X1.
 - 6) Indication of whether mix is appropriate for pumping.
 - 7) Indication of where each mix will be used.
 - 8) Calculations and tests results required by ACI 301 Article 4.2.3.
 - 9) Test results of total chloride content.
 - 10) Test results of cement when tested in accordance with ASTM C289.
 - 11) Where lightweight aggregate is used, test results per ASTM C330.
 - 12) Where normal weight aggregate is used, test results per ASTM C33.
 - 13) Manufacturer's certification of compliance for cement, aggregates, fly ash, and blast furnace slag.
 - 14) Manufacturer's certification that each admixture conforms to requirements of this Section and that admixtures are compatible with one another.
 - 15) If highly flowing (slump > 7") or self-consolidating (slump > 10"), test results showing resistance to aggregate separation as defined in Products section.
 - 2. Concrete Joint Plan:
 - a. Show all construction, control, and expansion joints in plan or elevation.
 - b. Provide section cut details through each proposed type of joint (including shear keys, joint dowels, waterstops and other accessories as required).
 - c. Show curbs, depressions, sleeves and openings.
 - d. Clearly identify, by circling with a cloud and adding the note "Engineer Verify," proposed construction joint locations beyond those shown in the drawings. Locations of proposed additional joints to be based on provisions in ACI 301 Section 2.2.2.5a.
 - e. Clearly identify, by circling with a cloud and adding the note "Architect Verify," proposed contraction joint locations beyond those shown in the drawings for concrete slabs on grade. Where contraction joints are not shown in the drawings, proposed locations to be based on provisions in ACI 302.1R.

f. This will be reviewed only for impact on performance of completed structure.

3. Penetration Plan:

- a. Using structural drawings as backgrounds, provide a single coordinated drawing for each level and/or wall and/or beam elevation, showing the size and location of all concrete slab openings, sleeves, cores and penetrations, including HVAC, electrical, telephone, fire sprinkler, plumbing and any other utilities.
- b. Show pipes or conduits routed through or embedded within all concrete structural elements such as beams, columns, footings, slabs and walls.
- c. Specifically identify openings and penetrations that will be cut or cored after concrete placement.

4. Submit proposed methods for cold and/or hot weather concreting when contemplated.

5. Provide samples of materials as required for testing and inspection.

6. Product Data: Submit product data for following products showing compliance with project specifications, compliance with referenced standards, manufacturer's recommendations, and known limitations.

- a. Curing materials.
- b. Non-shrink grout.
- c. Vapor retarder.

D. Information-Only Submittal:

1. Placement Plan: Submit schedule of concrete placement operations prior to commencement. Provide key plan identifying extent of each placement, or reference areas identified in approved Concrete Joint Plan submittal.

1.5 Project Record Documents

- A. Accurately record actual locations of embedded utilities and components that are concealed from view.
- B. Placement Record: Keep a record of batch tickets and times and dates of placing concrete at the job office, open to inspection by the Architect, Special Inspector, and Building Official.

1.6 Delivery, Storage and Handling

- A. Comply with ACI 301 Section 4.1.4.
- B. Deliver materials in manufacturer's unopened packaging including application instructions.
- C. Store materials in accordance with manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 Concrete Materials

A. Portland Cement:

1. ASTM C150:
 - a. Typically Type I or Type II cement, except:
 - b. Type I cement is not allowed for concrete in contact with soil.
2. ASTM C595:
 - a. Types S and SA cement not allowed.
 - b. Typically Type IS, Type IP, or Type P cement.

3. ASTM C1157:

- a. Typically Type GU or Type MS cement, except:
- b. Type GU cement is not allowed for concrete in contact with soil.

B. Supplementary Cementitious Materials (SCM):

1. Fly Ash: ASTM C618 Class F.
2. Ground Granulated Blast Furnace Slag (GGBFS): ASTM C989.
3. Natural Pozzolan: ASTM C10.
4. Silica Fume: ASTM C1240.
5. Contractor to comply with all applicable regulations concerning testing for, and limiting content of, hazardous materials in SCM.

C. Fine and Coarse Aggregates:

1. Normal Weight Aggregates: ASTM C33.
2. Maximum Aggregate Size: per the Structural Notes on the Structural Drawings. Note that if a range of sizes is given, the largest aggregate may be as small as the smallest size listed in that range.
3. Aggregates shall be well-graded, containing a range of intermediate sizes between sand and the maximum aggregate size.
4. Aggregates shall be free of alkali-silica reactivity. Evaluate aggregates for reactivity per ASTM C33 Appendix X1.
5. For concrete exposed to view in completed structure, provide aggregates from a single source.

D. Water: Clean, potable or recycled water meeting ASTM C1608, free from impurities detrimental to concrete, and conforming to requirements of ACI 318 Section 26.4.1.3.

2.2 Admixtures

A. General:

1. Do not use admixtures other than those included in the approved mix design submittal. If the use of additional admixtures is contemplated, mix design must be revised and resubmitted.
2. Admixtures must be compatible with other admixtures and with other components of concrete mix.
3. Do not use admixtures that will negatively impact finish of concrete exposed to view. For concrete exposed to view, finish shall not vary as a result of changes in use of admixtures.
4. Admixtures containing calcium chloride, thiocyanates, or more than 0.05 percent chloride ions, are not allowed.

B. Air Entraining Admixture: ASTM C260.

C. Water Reducing Admixture: ASTM C494, Type A.

D. Water Reducing, Retarding Admixture (Hydration Stabilizer): ASTM C494, Type D.

E. High-Range Water Reducing Admixture (Superplasticizer): ASTM C494, Type F or G.

F. Accelerating Admixtures:

1. ASTM C494, Type C or E.
2. Accelerating admixtures are not allowed unless specifically called out in the Construction Documents or explicitly approved by Architect and Engineer.
3. Admixture must be non-corrosive, substantiated by long-term test data (of at least a year's duration) from an independent testing laboratory using an acceptable accelerated corrosion test method.

G. Self-Consolidating Concrete Admixtures: ASTM C1017.

2.3 Related Materials

A. Non-Shrink Grout, Precision No-Shrink Grout, and Drypack Grout:

1. ASTM C1107, Grade C, non-metallic grout.
2. Minimum compressive strength of 2,400 psi in 48 hours and 5,000 psi in 28 days.
3. Add only enough water to meet both strength and consistency requirements. Do not add excess water.
4. Non-Shrink Grout:
 - a. Use where high fluidity and/or increased placing time are required; pour into void contained by temporary or permanent forms.
 - b. Products:
 - 1) "Five Star Grout" by U.S. Grout Corporation,
 - 2) "Masterflow 713 Plus" by Chemrex/BASF,
 - 3) "Masterflow 928" by Chemrex/BASF, or
 - 4) Approved equal or better substitution.
5. Drypack Grout:
 - a. Mix to a stiff plastic consistency and pack firmly into place.
 - b. Products:
 - 1) "Embeco 636 Grout" by Master Builders,
 - 2) "Euco Dry Pack Grout" by Euclid Chemical Company,
 - 3) "Masterflow Dry Pack" by Master Builders, or
 - 4) Approved equal or better substitution.
6. Repair Mortar:
 - a. Polymer-modified polyester fiber-reinforced repair mortar:
 - 1) BASF MasterEmaco S 488CI
 - 2) Simpson FX-263
 - b. Surface grey color blend-to-match smoothing compound:
 - 1) Rapid Set WunderFixx

B. Vapor Retarder: ASTM E1745 Class A reinforced polyethylene sheet, 20 mil thickness.

C. Granular Material: Self-draining granular fill, trimmable and compactable for use under vapor retarder.

D. Curing Materials:

1. Curing Compound: ASTM C309, Type 1, clear or transparent and does not discolor finished concrete surface or inhibit proper application or performance of surface finishes. Comply with Federal, state, and local VOC limits.

2. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

2.4 Concrete Mixes

A. General:

1. Assume full responsibility for meeting specified properties and for producing concrete that can be placed and finished in conformance with Contract Documents.
2. Proportion concrete mixes in accordance with contract documents and ACI 301 Section 4.2.3.
3. Use admixtures and products in accordance with the manufacturers' recommendations.
4. Cementitious materials and aggregates shall have a proven history of successful use with one another. Concrete mixes shall be free of alkali-silica reactivity.
5. Do not change brand, source, or proportion of any mix component without first submitting revised mix design and receiving review comments.
6. Verify that concrete mixes are not subject to aggregation segregation.
7. Default maximum ratio of water to cementitious material is 0.45.
8. Certain concrete mix properties are defined on the drawings.
9. Refer to Section 03 35 00 Concrete Finishes for additional concrete mix requirements.

B. Cementitious Materials:

1. Portland cement content not to exceed limit stated in General Notes on the structural drawings.
2. Provide supplementary cementitious material (SCM) content as required by Concrete Mix Schedule on the structural drawings, with the following additional requirements:
 - a. Ground granulated blast furnace slag (GGBFS) to be the primary SCM, i.e., at least half of SCM content by weight.
 - b. Fly ash content to be not less than 15 percent nor more than 30 percent of total cementitious material weight.
 - 1) Exception: at post-tensioned slabs, fly ash content is not required.
 - c. If used, natural pozzolan not to exceed 10 percent of total cementitious material weight.

C. Highly Flowing Concrete (Target Slump Greater than 7 inches):

1. ASTM C1610: Maximum allowable static segregation limit is 15 percent.
2. ASTM C1611 with a slump flow not to exceed 27 inches, with a tolerance of plus or minus 3 inches with respect to the design slump flow. In addition, Visual Stability Index shall not exceed a value of 1.0. Report the T50 values.

D. Self-Consolidating Concrete (Target Slump Greater than 10 inches):

1. Not to be used for slabs or other flatwork.
2. Meet the testing requirements for Highly Flowing concrete defined above, and the additional requirements defined below.
3. ASTM C1621: Passing ability of mix measured by J-ring test method shall not exceed 2 inches.

E. Proportioning of Aggregates:

1. Standard Practice for Selecting Proportions:
 - a. Normal weight concrete: ACI 211.1
2. Verify that aggregate size used is consistent with section being placed and amount of reinforcing steel.
3. Lightweight aggregates may not be used in normal-weight concrete.

F. Admixtures:

1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete as needed for placement and workability.
2. Ground granulated blast furnace slag is permitted.

G. Air Entrainment:

1. Concrete not exposed to freezing: Average air content not to exceed 3 percent.
2. Concrete exposed to freezing temperatures: Air content per ACI 201.2R, Table 1.1.

H. Do not exceed chloride limits in the ACI 318 Chapter 19.3.2.1 Commentary for the following member types:

1. Prestressed Concrete: concrete containing prestressing or post-tensioning tendons.
2. Non-Prestressed Concrete - C0: concrete that will be dry and protected from moisture in the completed structure.
3. Non-Prestressed Concrete - C1: concrete that will be exposed to the weather or in contact with soil in the completed structure.
4. Non-Prestressed Concrete - C2: concrete that will be exposed to the seawater, seaspray, or vehicular traffic.

I. Clarification of Mix Properties:

1. F'c is the minimum compressive strength at 28 days, unless noted otherwise, tested in accordance with ASTM C39.
2. Aggregate size is determined by largest coarse aggregate.
3. Air content is by volume. Tolerance is plus or minus 1.5 percent.
4. Water-cement ratio is the ratio of water to cementitious material by weight.
5. Concrete weight is maximum air-dry weight.
 - a. Normal-weight concrete to be between 135 and 160pcf, unless otherwise noted.

2.5 Source Quality Assurance

A. The Owner's Testing Agency will:

1. Review mix designs, certificates of compliance, and samples of materials Contractor proposes to use.
2. Take samples from Contractor's designated sources.

PART 3 - EXECUTION

3.1 Examination

- A. Verify site conditions.
- B. Verify requirements for concrete cover over reinforcement.
- C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, securely positioned, and will not impede placement of concrete.
- D. Verify that slab depressions, slopes for drainage, and other features shown on the drawings are identified and accommodated.

3.2 Installation of Slab-on-Grade Subgrade

- A. Install granular material on ground. Compact to 95%.
- B. Vapor retarder:
 - 1. Below enclosed spaces install vapor retarder above granular material in accordance with manufacturer's recommendations.
 - 2. Seal all edges.
 - 3. Repair all punctures and tears.

3.3 Preparation

- A. Prepare previously placed concrete by roughening surface to expose clean aggregate solidly embedded in mortar matrix and remove deleterious material: sand-blast, water-blast, or chip to provide 1/4-inch amplitude. Broom and vacuum clean.
- B. Clear away debris, loose material, and excess water from areas where concrete will be placed. Remove any material from in-place concrete or steel which will impair bond. Clean forms and reinforcing of drippings.
- C. Concrete in walls and columns from previous placement shall not project more than 3/8 inch vertically above the bottom of beams, drop caps and column capitals, and not more than 1/4 inch above the bottom of slabs thinner than 10 inches. Chip down such excess concrete after setting final form heights and before placing reinforcing or concrete above such horizontal joints.
- D. Construction & Control Joints:
 - 1. When construction joints occur at unplanned locations, notify Architect and Structural Engineer and obtain instruction prior to proceeding.
 - 2. Provide joints at locations noted on drawings, or as approved through action submittal.
 - 3. Include shear keys and dowels as required.
 - 4. Construction & control joints shall conform to ACI 318 Section 26.5.6.
 - 5. Roughen concrete surface for construction joint to an amplitude of approximately 1/4 inch.
 - 6. Construction joints to be saturated surface dry immediately prior to placing fresh concrete.
- E. Where concrete is placed on soil, thoroughly wet sub-grade prior to placement.

F. Before placing concrete, complete formwork and reinforcing inspections. Install all reinforcement and embeds prior to start of concrete placement. Wet-setting of reinforcement and/or embeds is not acceptable.

G. Do not place architectural concrete prior to acceptance of field samples.

3.4 Placing Concrete

A. Mix and deliver concrete in accordance with ASTM C94.

B. Water:

1. Do not add water after batching except as allowed by ASTM C94. Added water to come only from truck tank and to be verified by inspector. Inspector to verify that total water content does not exceed the amount specified in the mix design.
2. Do not add water outside of truck at job site. Concrete cylinder samples shall only be taken after all water has been added.
3. Discharging chute wash water into pump hopper is strictly forbidden.

C. Conveying:

1. Do not subject concrete to any procedure that will cause aggregate segregation. Deposit concrete as closely as possible to its final position.
2. Do not use aluminum pipes or chutes.
3. Comply with ACI 301 Section 5.3.2.2.

D. Deposit concrete such that no new concrete will be placed on concrete that has hardened sufficiently to cause a cold joint.

1. Deposit concrete in accordance with ACI 318 Section 26.5.2. The unconfined vertical drop of concrete from the end of hoses or other conveying equipment to the placement surface shall not be greater than 4 feet for concrete with target slump less than or equal to 7 inches, and no greater than 2 feet for concrete with target slump greater than 7 inches (highly flowing or self-consolidating concrete).
2. Deposit concrete in its final position within ninety (90) minutes after batch mixing unless otherwise allowed. In hot weather, reduce this time limit so that stiffening of concrete does not occur until after it has been placed.

E. Place concrete in columns, walls, beams and joist stems prior to placing concrete slabs.

F. Consolidation:

1. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Vibrate concrete, but not against reinforcing.
2. Do not use vibrators to transport concrete.
3. Insert and withdraw vibrators vertically at uniformly spaced locations no farther apart than visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.
 - a. Highly flowing concrete: moderate vibration still required, but carefully controlled to prevent aggregate segregation.
 - b. Self-consolidating concrete: vibration not required.

4. Keep a standby vibrator in good working order, but not in use, at the site.
5. If a top layer of watery paste, deeper than typical “bleed water” and free of coarse aggregate, occurs:
 - a. Immediately take measures to reduce aggregate segregation,
 - b. Immediately verify that no water was added to the concrete in transit or on site,
 - c. Immediately inform General Contractor and Special Inspector,
 - d. Overpour and skim off layer lacking coarse aggregate,
 - e. Take additional samples of in-place concrete for concrete compression tests,
 - f. Inform Architect and Structural Engineer.

G. Flatwork:

1. Level and finish slab to specified degree of flatness and finish called for in Specification Section 03 35 00, Concrete Finishes.
2. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains 1/4 inch per foot or as indicated on Drawings.

H. Hot Weather Placement: When hot weather conditions exist, comply with ACI 305.1 and as specified below.

1. “Hot weather conditions” are defined as:
 - a. Air temperature above 90 degrees Fahrenheit for casting or shooting of elements thicker than three feet.
 - b. Air temperature above 95 degrees Fahrenheit for casting or shooting of other elements.
2. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 degrees Fahrenheit. Mixing water may be chilled or chopped ice may be used to control temperature, provided that water equivalent of ice is added to total reported amount of mix water.
3. Cover reinforcing steel with water-soaked burlap if steel temperature will exceed ambient air temperature.
4. Fog-spray forms, reinforcing steel, and subgrade immediately prior to concrete placement. Keep subgrade moisture uniform without puddles or dry areas.
5. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

I. Cold Weather Placement:

1. Implement submitted cold weather procedures for placement of concrete when ambient temperature is less than 40 degrees Fahrenheit or when temperature is expected to drop below 40 degrees Fahrenheit during the following three days.
2. Comply with ACI 306.1.
3. Maintain a record of concrete surface temperature for first 7 days after each pour. This record shall be open to inspection by Architect and Structural Engineer.

J. Do not disturb reinforcement, inserts, embedded parts, formed joint fillers, joint devices during concrete placement.

3.5 Concrete Finishing and Curing

- A. Refer to Section 03 35 00 for detailed provisions regarding finishes and tolerances of floors.

- B. Flatness and Levelness: Unless otherwise noted, provide the following flatness and levelness per ASTM E1155, for both slabs-on-grade and elevated slabs:
1. Parking garages: FF20, FL15.
 2. Warehouse slabs with high-stack shelves and storage racks: FF 30-35, FL 20-25.
 3. Carpeted interior spaces: FF25, FL20.
 4. Slabs to receive thin-set flooring: FF30, FL20.
- C. Requirements:
1. See Section 03 35 00 for additional curing requirements.
 2. Maintain concrete above 50 degrees Fahrenheit and in a moist condition for at least 7 days after placement.
 3. Comply with ACI 301 Section 5.3.6.
 4. Avoid alternate wetting and drying and fluctuations of concrete temperature.
 5. Do not permit curing method to adversely affect finishes or treatments applied to finish concrete.
- D. Whenever formwork is removed during the curing period, cure exposed concrete by one of the specified methods.

3.6 Cleaning and Protection

- A. Clean surface of exposed concrete of foreign material. Protect concrete from damage and discoloration.

3.7 Defective Work and Repairs

A. Defective Concrete:

1. Special Inspector shall notify Architect and Structural Engineer of honeycombing or other observed defects, such as "bug holes", aggregate segregation, lamination or sand pockets. Where defects are observed, Inspector shall sound concrete and chip to expose any suspected voids.
2. For visually exposed concrete, also report any lack of uniformity in appearance.

B. Repair:

1. Repair methods shall be submitted to the Architect and Structural Engineer for approval.
2. Chip out all loose or poorly consolidated material. Score the perimeter with a shallow bevel cut so the repair grout is "keyed" into the base material. Preserve existing reinforcing, do not cut.
3. Cavity repair:
 - a. Method 1:
 - 1) Repairs cavities in flat downhand or vertical surfaces.
 - 2) Apply bonding agent such as Larsen Products' Weld-Crete
 - 3) Drypack nonshrink grout with limited water added to achieve grout strength 2,000 psi greater than the shotcrete's specified strength

- 4) For voids greater than ABOUT 2" cubed (i.e. 8 cubic inches), the grout shall contain 3/8" aggregate.
- b. Method 2 :
 - 1) Repairs cavities in flat downhand, vertical or overhead surfaces.
 - 2) Cavity surface prep options:
 - a) Water soak to create a saturated surface-dry (SSD) condition, OR
 - b) Apply bonding agent
 - 3) If reinforcing is corroded, wire brush or sand blast to clean bright steel. Apply corrosion-inhibitor.
 - 4) Scrub surface with small amount of repair mortar to promote bond
 - 5) Fill cavity with trowelled-on polymer-modified fiber-reinforced repair mortar (see Repair Mortar products)
4. Where exposed to public view:
 - a. If repair mortar color does not match surrounding concrete, apply surface grey color blend-to-match smoothing compound (see Repair Mortar products)
5. Repair core test holes in accordance with ACI 301.
6. Repair tie holes in accordance with ACI 301 Section 5.3.7.2.

3.8 Grouting

- A. Mix grout in accordance with the manufacturer's instructions to a consistency which will permit placement. Place grout in accordance with manufacturers' recommendations. Place grout so as to ensure complete bearing and elimination of air pockets.

3.9 Field Quality Assurance

- A. General:
 1. Notify Owner's Testing Agency, Architect, and Structural Engineer at least two business days prior to concrete placement.
- B. All tests and inspections specified in this section, including preparation of samples, will be performed by Owner's Testing Agency.
- C. As a minimum, comply with special inspection provisions of CBC Section 1705.3.
- D. Continuously inspect concrete and grout placement operations.
- E. Batch Tickets:
 1. Collect batch ticket for each batch of concrete delivered to job site.
 2. Batch ticket to include:
 - a. Number or other identification of mix design.
 - b. Signature or initials of batch plant representative.
 - c. Time of batching.
 - d. Weight of cementitious materials, aggregates, water and admixtures in batch.
 - e. Total volume of concrete in batch.
 - f. Notation to indicate equipment was checked for contaminants prior to batching.
 3. Retain batch tickets and submit as project record document.
- F. Verify use of required design mix for specific location. Check number or other identification of mix design against concrete mix design submittal.
- G. Sampling Fresh Concrete: ASTM C94.

1. Sample concrete at point of discharge from truck.
2. Measure and document slump at point of discharge from truck when each set of concrete compression cylinders is taken.
3. If slump for batch exceeds target slump and tolerance in ASTM C94 for that class of concrete:
 - a. Immediately inform Contractor so that corrective action can be taken if appropriate,
 - b. Take additional slump tests and compression cylinders as appropriate.
4. Inspector to also visually monitor discharge of concrete at point of placement. If evidence of inappropriately added water or aggregate segregation or other change of consistency is observed:
 - 1) Immediately inform Contractor so that corrective action can be taken if appropriate,
 - 2) Take additional slump tests and compression cylinders as appropriate.
5. For concrete exposed to freezing, test air content when a set of compression cylinders are taken. When self-consolidating concrete is used, fill base in one layer with no rodding.
6. Concrete Temperature: One test for each set of compressive-strength specimens, one test hourly when air temperature is 40 degrees Fahrenheit and below or 80 degrees Fahrenheit and above.
7. Compression Test Samples:
 - a. Sample frequency shall as a minimum be in accordance with ACI 318 Section 26.12.2.
 - b. Take a sample from each 150 cubic yards of each class of concrete or fraction thereof, or from each 5,000 square feet of surface area for slabs or walls placed each day. A “class” of concrete is defined as each unique concrete mix design.
 - c. Each compressive-strength sample consists of a set of at least five standard cylinders (one at 28 days for information, three to test at specified test age for acceptance, plus one hold).
 - 1) Take additional cylinders (such as at 7 days) when early tests are required for removal of formwork shoring.
 - 2) Either 4"x8" or 6"x12" cylinders may be used. If 6"x12" cylinders are used, the number of cylinders per sample may be reduced by one, with two tested at specified age instead of three.
 - 3) Test cylinders per ASTM C39, except cure per requirements below.
 - d. When self consolidating concrete is used, fill cylinders in one layer with no rodding.
 - e. When field cured cylinders are required, such as for formwork shoring comply with ACI 318 Section 26.5.3.2 (d).
 - f. Make additional cylinders at the expense of the Contractor when requested.
 - g. Number and date each cylinder. Keep an accurate record of the location of the pour that each set represents.
 - h. Curing:
 - 1) Except as noted below, samples may be field or laboratory cured.
 - 2) If cylinders are to be used to justify early removal of forms or shoring make additional cylinders for this purpose and field cure.
8. Acceptance: Strength level of concrete will be considered satisfactory if it meets the criteria of ACI 318 Section 26.5.3.2 (e).
9. Test results will be reported in writing to Architect, Structural Engineer, and Contractor within 24 hours after tests.

10. Reports of compressive strength tests will contain project name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength, and compressive breaking strength for all tests. Tests results for breaks at the specified test age shall also include acceptance status.
- H. Field Testing of Self-Consolidating Concrete:
1. ASTM C1610.
 2. Report slump flow, T50 values, and visual stability index using ASTM C1611.
 3. ASTM C1621, using the J-ring test method.
- I. Test flatwork surfaces for flatness and levelness within 72 hours of casting of concrete. Test unformed surfaces sloped to drain for trueness of slope and smoothness.
- J. Verify that specified curing temperatures and procedures have been complied with.

END OF SECTION 03 30 00

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 Summary

- A. This Section includes but is not necessarily limited to the following:
1. Materials and installation of cold-formed light-gauge metal stud framing.
 2. Accessories and other related items.

B. Related Sections:

1. Section 09 21 16, Gypsum Board Assemblies.

1.2 References

- A. Published specifications, standards, test methods or other documents listed below are invoked where cited by abbreviations noted below. Latest editions of references apply unless a specific date or edition is listed.
1. California Building Code (CBC), California Code of Regulations, Title 24, Part 2.
 2. American Iron and Steel Institute (AISI):
 - a. AISI S100, "North American Specification for the Design of Cold-Formed Steel Structural Members."
 - b. AISI S200, "Standard for Cold-Formed Steel Framing – General Provisions."
 3. American Society for Testing and Materials (ASTM):
 - a. ASTM A36, "Standard Specification for Carbon Structural Steel."
 - b. ASTM A123, "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products."
 - c. ASTM A153, "Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware."
 - d. ASTM A653, "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process."
 - e. ASTM A780, "Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings."
 - f. ASTM A1003, "Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members."
 - g. ASTM C150, "Standard Specification for Portland Cement."
 - h. ASTM C404, "Standard Specification for Aggregates for Masonry Grout."
 - i. ASTM C754, "Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products."
 - j. ASTM C954, "Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness."
 - k. ASTM C955, "Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases."
 - l. ASTM C1007, "Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories."
 - m. ASTM C1513, "Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections."

- n. ASTM F1554, "Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength."
- 4. American Welding Society (AWS):
 - a. AWS D1.1, "Structural Welding Code – Steel."
 - b. AWS D1.3, "Structural Welding Code – Sheet Steel."
- 5. Society for Protective Coatings (SSPC):
 - a. SSPC-Paint 20, "Zinc-Rich Coating, Type I – Inorganic and Type II – Organic."
 - b. SSPC "Painting Manual."

1.3 Definitions

- A. Evaluation Service Report (ESR): Product testing report from ICC Evaluation Service or equivalent from another approved agency.
- B. SLRS: Seismic Load Resisting System.
- C. See AISI S200, Section A2, for additional definitions.

1.4 Submittals

- A. Review of submittals is of a general nature only, and responsibility for conformance with Contract Documents remains with the Contractor. Review does not imply or state that Contract Documents have been interpreted correctly.
- B. Submittal Protocol:
 - 1. Submit items per Division 01.
 - 2. Coordination Notes: Clearly identify, by circling with a cloud and adding the note "Engineer Verify," the following:
 - a. Specific situations not addressed in the Construction Documents,
 - b. Proposed variations from the Construction Documents, or
 - c. Clarification requests (clearly note the nature of the question).
- C. Information-Only Submittals:
 - 1. Submit manufacturer's recommendations and recommended installation procedures for products and accessories.
 - 2. Submit mill certificates from steel sheet producer, or test reports from a qualified independent testing agency, showing that light-gauge material conforms to the requirements of this Section. Provide uncoated steel thickness, yield strength, tensile strength, total elongation, chemical constituents and coating thickness.
 - 3. Welding Procedure Specifications (WPS) and Procedure Qualification Records (PQR): Submit in accordance with AWS D1.1 and D1.3.
 - 4. Welder Performance Qualification Records (WPQR): Submit in accordance with AWS D1.1 and D1.3.
 - 5. Submit electrode manufacturer's certification that electrodes meet the requirements of their respective classifications.
 - 6. Submit evidence of installers' qualifications.

1.5 Quality Assurance

- A. Qualifications:

1. Installer to have successfully completed three projects of similar scope and size to that indicated for this Project.
2. Welders to be qualified in accordance with AWS D1.3 for welding process, position, type of weld and type of steel.

1.6 Delivery, Storage and Handling

- A. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage. Damaged products will not be accepted at final inspection.
- B. Acceptance at Site: Products must be in manufacturer's original unopened containers with labels indicating brand name, model and grade.
- C. Storage and Protection:
 1. Products shall be stored above ground on level platforms, at least 6 inches above ground, allowing air circulation under stacked units.
 2. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.
 3. Protect metal framing products from corrosion, deformation and other damage.

PART 2 - PRODUCTS

2.1 General

- A. Conform to AISI S200. For design/build items, also conform to AISI S100.

2.2 Materials

- A. Steel Sheet: ASTM A1003.
 1. Grade 33 Type H, for all material 43 mils (18 ga) and lighter.
 2. Grade 50 Type H, for all material 54 mils (16 ga) and heavier.
- B. Identify material as required by CBC Section 2203.3.
- C. Minimum base metal thickness of cold-formed steel members as required by AISI S200 Table 5.1.1.

2.3 Components

- A. Identify products as required by AISI S200 section A5.4.
- B. Product designations to comply with AISI S200 section A5.2.
- C. Steel Studs, Joists, Tracks and Channels: Comply with ASTM C955 and ICC-ES Report No. ER-4943P.
 1. Structural section properties shall be computed in accordance with AISI S100, and meet or exceed those specified for the corresponding member size in ICC-ES Report No. ER-4943P.
 2. Provide punched webs for studs.
 3. Zinc coating per ASTM A653, G60 minimum, chemically treated not oiled.
- D. Proprietary Studs:

1. Jamb studs as manufactured by The Steel Network, Fy = 50 ksi.
 2. Sigma Studs as manufactured by The Steel Network, Fy = 50 ksi.
- E. Furring and U channels:
1. ASTM A1003 Grade 33 Type H for all members.
 2. Zinc coating per ASTM A653, G60 minimum.
- F. Straps:
1. ASTM A1003 Grade 50 Class 1 or Class 3.
 2. Zinc coating per ASTM A653, G60 minimum.
- G. Deflection Tracks: Fire Trak deflection tracks as manufactured by Fire Trak Corp.
1. Thickness of deflection tracks: 12 gauge at exterior walls and 14 gauge at interior walls unless noted otherwise in the Structural Drawings.
 2. Stud positioning device: Posi Klips.
- H. Slotted Top Tracks: SLP-TRK as manufactured by Sliptrack Systems and conforming to ICC-ES Report No. ESR-1042.
- I. Vertical Deflection Clips:
1. VertiClip, manufactured by The Steel Network and complying with ICC-ES Report No. ESR-1903.
 2. DriftClip, manufactured by The Steel Network.
- J. Manufactured Light-Gauge Connectors:
1. Default surface treatment: zinc coating per ASTM A653, G90.
 2. Manufacturers:
 - a. The Steel Network.
 - b. Simpson Strong-Tie Connectors.
- K. Sure-Board:
1. Sure-Board 200 manufactured by Cemco and complying with IAPMO ES ER-0126.
 2. Board or Sheathing:
 - a. Interior Assemblies: Type X gypsum board complying with ASTM C1396.
 - b. Exterior Assemblies: Glassmat gypsum sheathing complying with ASTM C1177.
 - c. Refer to Section 09 29 00 for additional information regarding gypsum sheathing to be factory applied to metal panel.
 3. Adhered sheet steel:
 - a. 22 ga (.027", 27 mil) minimum base metal thickness
 - b. ASTM A653, Grade 33 minimum.
 4. Screws to attach Sure-Board:
 - a. ASTM C954.
 - b. Self-drilling, #8 minimum shank diameter (0.138") with 3/4" long drill tip and 1-1/4" overall length.
 - c. Bugle head drilled flush with panel surface.

- d. Screw penetration through cold-formed steel framing member: minimum three exposed threads.
- e. 3/8" minimum edge distance in cold-formed framing member.

L. Steel Sheet:

- 1. 18ga (43 mil) or thinner: ASTM A1003 Grade 33 Type H
- 2. 16 ga (54 mil) or thicker: ASTM A1003 Grade 50 Type H

2.4 Accessories

- A. Steel Shapes and Plates: ASTM A36, galvanized as per ASTM A123.
- B. Anchor Bolts: ASTM F1554, Grade 55 minimum unless otherwise noted in Structural Drawings, with hardened steel washers; galvanized per ASTM A153, Class C.
- C. Powder-Driven Fasteners (PDF): Fasteners to have guide washers, minimum shank diameter of 0.145 inches and manufacturer's standard corrosion-resistant coating.
 - 1. Driven into concrete with embedment per Installation article unless otherwise noted in the Drawings:
 - a. Hilti X-DNI conforming to ICC-ES Report No. ESR-1663,
 - b. Hilti X-U conforming to ICC-ES Report No. ESR-2269,
 - c. Powers 0.300-inch drive pin conforming to ICC-ES Report No. 2024,
 - d. Simpson Strong-Tie PDP conforming to ICC-ES Report No. ESR-2138, or
 - e. Approved equal or better substitution.
 - 2. Driven into structural steel:
 - a. Hilti X-EDNI conforming to ICC-ES Report No. ESR-1663,
 - b. Hilti X-U conforming to ICC-ES Report No. ESR-2269,
 - c. Powers 0.300-inch knurled drive pin conforming to ICC-ES Report No. 2024,
 - d. Simpson Strong-Tie PDPH conforming to ICC-ES Report No. ESR-2138, or
 - e. Approved equal or better substitution.
- D. Sheet Metal Screws:
 - 1. ASTM C1513, self-drilling/tapping screws.
 - 2. Thread Pitch: In accordance with manufacturer's recommendations for the thicknesses of material being connected.
 - 3. Head Type: Low-profile head (wafer head) beneath sheathing, manufacturer's standard elsewhere.
 - 4. As a minimum, all screws to receive corrosion protection applied by methods that prevent hydrogen embrittlement (HE) or hydrogen-assisted stress corrosion cracking (HASCC), such as:
 - a. Dual hardness with core hardness no greater than Rockwell C36, or
 - b. Mechanical zinc plating and treatment with proprietary organic coating proven through testing to remain in place after driving screw into base material, or
 - c. Zinc electroplating with post-baking at 400 to 425 degrees Fahrenheit for four hours within one hour after plating, followed by testing of each production lot for hydrogen embrittlement as follows:
 - 1) Place a hardened washer on the screw and drive into hardened, untapped test plate with thickness greater than one thread diameter.
 - 2) Using a calibrated torque wrench, drive five screws into test plate until screws fail and record torque values at failure.
 - 3) Calculate testing torque as 80 percent of average failure torque.

- 4) Drive eight randomly selected screws into test plate using testing torque and hardened washers.
 - 5) Leave screws in test plate and re-tighten to testing torque at 24, 48 and 72 hours after initial installation.
 - 6) Lot is acceptable only if no screws break before or during application of testing torque at 24, 48 or 72 hours after initial installation.
5. Where screws are exposed to weather or soil, or in contact with treated wood, submit product data demonstrating that corrosion resistance is appropriate to intended service life of structure.
- E. Welding Electrodes: E6x minimum. Conform to AWS D1.1 and AWS D1.3. Use low-hydrogen electrodes.
- F. Touch-up Primer for Galvanized Surfaces: SSPC-Paint 20 zinc-rich.
- G. Cement Grout: Portland cement, ASTM C150, Type 1; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

2.5 Fabrication

- A. Quality of materials and workmanship of shop-fabricated components or assemblies shall be the same as specified in Part 3.
- B. Inside bend diameter of all fabricated items shall not be less than 1.5 times the material thickness.
- C. Bottom tracks for bearing walls shall be brake shapes with sharp corners, not rolled tracks with rounded corners.

2.6 Shop Quality Assurance

- A. Testing and inspection of shop-fabricated components or assemblies shall be the same as specified in Part 3 of this Section.
- B. Owner's Testing Laboratory will provide inspection of shop fabrication per CBC Section 1704.2.

PART 3 - EXECUTION

3.1 General

- A. Conform to AISI S200.

3.2 Examination

- A. Site Verification of Conditions:
 1. Prior to executing any work specified under this Section, inspect installed work executed under other Project Manual sections that affect the execution of work under this Section.
 2. Carefully coordinate all requirements for pipes and other items designed to be housed within partition, wall or ceiling systems.
 3. Carefully coordinate all requirements for backing support of items to be mounted on finished walls.

- B. Notify Architect, in writing, of any conditions detrimental to the proper and timely completion of the Work.
- C. Do not proceed with installation of metal framing until unsatisfactory conditions have been corrected.

3.3 Preparation

- A. Protection:
 - 1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment and other damage from work specified under this Section.
 - 2. Coordinate installation of cold-formed framing with application of other systems.
- B. Surface Preparation:
 - 1. Prepare surface in accordance with manufacturer's instructions and recommendations.
 - 2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) that could impair bond of materials specified within this section.

3.4 Installation

- A. General:
 - 1. Install all products in accordance with manufacturer's recommendations.
 - 2. Comply with the requirements of ASTM C754 and ASTM C1007.
- B. Complete, uniform and level bearing support shall be provided for the bottom track at each bearing-stud location. Grout or install full metal shims below bottom track at stud locations as needed to ensure full contact.
- C. Bearing wall studs shall sit squarely in top and bottom runner tracks with firm abutment against track webs. Curtain wall and interior non-bearing studs shall sit in top and bottom tracks with 1/16-inch maximum gap between wall stud and track web.
- D. Layout:
 - 1. Lines to be straight and true.
 - 2. Install studs plumb, with open sides facing in same direction.
 - 3. Install framing members in one-piece lengths, except where splice connections are indicated in the Structural Drawings.
 - 4. Space studs 16 inches on center maximum unless otherwise noted in the Structural Drawings.
 - 5. Align joists, rafters and trusses with wall studs in accordance with AISI S200 section C1.
 - 6. Separate floor joist webs from rim track webs in accordance with AISI S200 section C3.3.5.
 - 7. Form corners with a minimum of three studs.
 - 8. Runner tracks shall be attached to concrete with PDF at 12 inches on center, unless otherwise noted.

9. Provide bridging for studs unless there is full height sheathing on both sides:
 - a. Bridging rows spaced 4 feet maximum on center.
 - b. Stud bridging shall brace both flanges (see Structural Drawings for typical detail).
 10. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of each joint.
- E. Install insulation in exterior framing members that are inaccessible on completion of framing work.
- F. Web Punch-Outs and Web Holes:
1. Locate and align web punch-outs to facilitate installation of bridging, pipes and conduits.
 2. Locate web punch-outs not closer than 10 inches or 1.5 times the web dimension, whichever is greater, from bearing points.
 3. Locate web holes only where shown in the Structural Drawings.
- G. Cutting:
1. Cut holes in framing members only as specifically permitted in the Construction Documents. Do not cut or notch stud flanges or cut additional opening in webs.
 2. Cut framing members by sawing, shearing or plasma cutting.
 3. Where holes must be cut and there is no provision for holes in framing members obtain permission from the Architect.
- H. Tolerances: Maximum variation in plane and true position between fabricated panels or abutting members not exceeding 1/16 inch.
- I. Abutting or intersecting pieces of track shall be spliced together or securely anchored to a common structural element.
- J. Joining of members shall be made with welding, screws, bolts or PDF as defined in the Construction Documents.
- K. At compensation channels and other connections designed to move, use special care not to attach components temporarily or permanently, so as to prevent movement.
- L. Bolted Connections:
1. Drill holes a maximum of 1/16 inch larger than specified bolt diameter.
 2. Torch cutting of holes is not permitted.
 3. Bolts shall be installed snug-tight.
- M. Metal Screws:
1. Install in accordance with AISI S200 Section D1, manufacturer's recommendations and applicable ESR.
 2. Screws to extend through connected parts so that a minimum of three threads are exposed.
 3. Penetrate individual components of connections without causing permanent separation between components.

4. If screw threads are stripped provide additional screws. Notify Architect if this cannot be done while complying with spacing limitations.
5. Use flat head screws when attaching wood sheathing.
6. Screws to gypsum board panel sheathing: ASTM 954.

N. Powder-Driven Fasteners:

1. Install in accordance with manufacturer's recommendations and applicable ESR.
2. Fasteners shall be driven so that shank penetrates through steel members except when allowed by applicable ESR.
3. Do not install fasteners into concrete until concrete has obtained its minimum specified strength.
4. When installed in concrete, embedment shall be 1-1/4 inch minimum, except at elevated post-tensioned slabs, where embedment shall be no less than 5/8" and no more than 3/4".

O. Welding:

1. Comply with AWS D1.1, AWS D1.3 and AISI S200 Section D2.
2. Welding is only permitted on material 43 mil (18 gauge) and thicker.

P. Framing clips and other attachment hardware: Fill all fastener holes with the maximum number and size of connectors (nails, bolts, etc.) unless otherwise noted in the Structural Drawings.

Q. Install deflection tracks and slotted top tracks in accordance with applicable ESR and manufacturer's recommendations.

R. Install supplementary framing, blocking, backing and bracing in stud framing as required by fixtures, equipment, services, casework, trim, furnishings and other items requiring attachment to framing.

S. Verify that any pre-drilling of backing and attachment of spacers to prevent crushing of collateral material is done prior to application of collateral material.

T. Temporary Bracing: Contractor is responsible for:

1. Determination of all temporary bracing requirements.
2. Location, design and installation of temporary bracing components.
3. Retaining the services of a California-licensed civil or structural engineer when required.

U. Diagonal strap bracing and metal straps: Install taut.

V. Sure Board: Install Sure-Board panels per manufacturer's recommendations.

W. Isolate piping with a non-corrosive system to prevent galvanic action or abrasion.

X. Isolate electrical wiring not encased in conduit from framing using non-conductive non-corrosive grommets or equivalent means.

3.5 Repair and Restoration

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings, with galvanized repair paint according to ASTM A780 and manufacturer's written instructions. Damaged galvanized coating includes but is not limited to damage resulting from welding.

3.6 Field Quality Assurance

- A. Tests and Inspections:

1. As required by regulatory agency if in excess of what is otherwise specified herein.
2. Schedule inspections and notify Owner's Testing Agency, Architect, and Project Inspector at least 48 hours prior to the inspection.

- B. The Owner's Testing Agency will:

1. Provide periodic inspection of welding of interior partitions.
2. Provide continuous inspection of welding that is a part of exterior walls.
3. Verify sizes and configuration of members in accordance with CBC Table 1704.3, Item 6.
4. Provide special inspection per CBC Section 1707.4 for members of the Seismic Load Resisting System (SLRS).
5. Provide periodic inspection of welding in accordance with AWS D1.1 and AWS D1.3 and Exception 2.4 of CBC Section 1704.3.
6. Welding inspections will include prior fit-up, welding equipment, weld quality and welder certification in accordance with AWS D1.1 and AWS D1.3 and CBC Section 1704.3.1.
7. Visually inspect welds.
8. Inspections as a minimum will include inspection of all fastening components.
9. Verify that all stud cavity walls are free of moisture prior to any other construction that encloses wall cavity.
10. Test expansion bolts.

3.7 Cleaning

- A. Clean any soiled surfaces immediately.

END OF SECTION 05 40 00

SECTION 05 5000

METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel framing and supports for overhead doors and grilles.
2. Steel framing and supports for countertops.
3. Steel tube reinforcement for low partitions.
4. Steel framing and supports for mechanical and electrical equipment.
5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
6. Slotted channel framing.
7. Shelf angles.
8. Metal ladders.
9. Metal floor plate and supports.
10. Elevator pit sump covers.
11. Miscellaneous steel trim including steel edgings.
12. Metal bollards.
13. Abrasive strips.
14. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Sections:

1. Section 03 3000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 04 2000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Section 05 1200 "Structural Steel Framing."

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. 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.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
1. Fasteners.
 2. Shop primers.
 3. Slotted channel framing.
 4. Manufactured metal ladders.
 5. Metal bollards.
- B. Sustainable Design Submittals:
1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 3. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs that conform to USGBC guidelines and have at least a cradle to gate scope and demonstrates product complies with required Global Warming Potential Baseline.
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
1. Steel framing and supports for overhead doors and grilles.
 2. Steel framing and supports for countertops.
 3. Steel tube reinforcement for low partitions.
 4. Steel framing and supports for mechanical and electrical equipment.
 5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 6. Shelf angles.
 7. Metal ladders.
 8. Metal floor plate and supports.
 9. Miscellaneous steel trim including steel edgings.
 10. Metal bollards.
 11. Loose steel lintels.
- D. Samples for Verification:
1. Abrasive strip.
- E. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
- B. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.
- C. Welding certificates.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
- E. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- C. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- D. Sustainability Requirements:
 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.
- E. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section when available.
1. Provide a Product-Specific Type III Environmental Product Declaration (EPD), that meets the following parameters, and documents that each product's Global Warming Potential (GWP) is at least 20% better than the Carbon Leadership Forum (CLF) BETA Embodied Carbon Baselines dated 2019.11.16 as found on EC3 and as listed below for reference:
 - a. Embodied Carbon (GWP) Baselines: Steel
 - 1) Rebar – 2.0 kg CO₂eq per kg/.91 kg CO₂eq per lb.
 - 2) Wire & Mesh – 3.0 kg CO₂eq per kg/ 1.4 kg CO₂eq per lb.
 - 3) Plate Steel 3.0 kg CO₂eq per kg/1.4 kg CO₂eq per lb.
 - 4) Structural Steel
 - a) Hot-Rolled – 2.5 kg CO₂eq per kg/ 1.1 kg CO₂eq per lb.
 - b) Hollow – 2.5 kg CO₂eq per kg/ 1.1 kg CO₂eq per lb.
 - 5) Cold Formed Steel – 3.0 kg CO₂eq per kg/ 1.4 kg CO₂eq per lb.
 - b. System Boundary: Product Stage A1-A3.
 - c. Declared Units: 1 kilogram or 1 pound.
 2. Product Category Rules:
 - a. Institut Bauen und Umwelt e.V. PCR for Structural Steels, v.1.0/1.6/1.0, 2017-11-30.
 - b. Institut Bauen und Umwelt e.V. PCR for Thin walled profiles and profiled panels of metal, v.1.0/1.7/1.0, 2019-01-08
 - c. International EPD System PCR for Basic iron or steel products & special steels, except construction products, v.2.0, 2020-03-27.
 - d. UL Environment PCR for Designated Steel Construction Products, v.2.0, 2020-12-31.
 3. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
- D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- E. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- F. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- G. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- H. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
- I. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 1. Size of Channels: As indicated.

2. Material: Cold-rolled steel, ASTM A 1008/A 1008M, structural steel, Grade 33; 0.0677-inch minimum thickness; unfinished.
- J. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 1. Provide stainless-steel fasteners fastening aluminum or stainless steel.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.
- D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- E. Eyebolts: ASTM A 489.
- F. Machine Screws: ASME B18.6.3.
- G. Lag Screws: ASME B18.2.1.
- H. Wood Screws: Flat head, ASME B18.6.1.
- I. Plain Washers: Round, ASME B18.22.1.
- J. Lock Washers: Helical, spring type, ASME B18.21.1.
- K. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- L. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- M. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

- N. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Section 09 9113 "Exterior Painting." And Section 09 9123 Interior Painting."
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.
 - 1. Basis of Design: Subject to compliance with requirements, provide DuragROUT by L&M/Laticrete or a comparable product by one of the following:
 - a. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
- F. Concrete: Comply with requirements in Section 03 3000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. 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.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.

4. 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. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 1. Fabricate units from slotted channel framing where indicated.
 2. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.

2.7 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
 1. Provide mitered and welded units at corners.
 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. Galvanize shelf angles located in exterior walls.
- C. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3, except for elevator pit ladders.
 - 2. For elevator pit ladders, comply with ASME A17.1.
- B. Steel Ladders:
 - 1. Space siderails 18 inches apart unless otherwise indicated.
 - 2. Space siderails of elevator pit ladders 12 inches apart.
 - 3. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
 - 4. Rungs: 3/4-inch-diameter steel bars.
 - 5. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 - 6. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
 - 7. Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 1/2 inch in least dimension.
 - 8. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
 - 9. Galvanize exterior ladders, including brackets and fasteners.

2.9 METAL FLOOR PLATE

- A. Fabricate from rolled-steel floor plate of thickness indicated below:
 - 1. Thickness: 1/4 inch ([6.4 mm](#)).
- B. Provide grating sections where indicated, fabricated from welded or pressure-locked steel bar grating. Limit openings in gratings to no more than 3/4 inch ([19 mm](#)) in least dimension.
- C. Provide steel angle supports as indicated.
- D. Include steel angle stiffeners, and fixed and removable sections as indicated.
- E. Provide flush steel bar drop handles for lifting removable sections, one at each end of each section.

2.10 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize exterior miscellaneous steel trim.

2.11 METAL BOLLARDS

- A. **Basis-of-Design Product:** Subject to compliance with requirements, provide product indicated below or comparable product by one of the following:
 1. ULine Safety Bollards - #H5556 – 48 inches high, removable.
 2. Uline Machine Guards - #H-2120 – 42 inches high, removable.
 3. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
- B. Fabricate bollards with 3/8-inch-thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.
 1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.
- C. Provide manufacturers standard hardware assembly for removable bollards.
- D. Finish: manufacturer's standard bright yellow paint finish.

2.12 ABRASIVE STRIPS

- A. Extruded Units: Aluminum units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.
 1. Basis of Design: Subject to compliance with requirements, provide Amstep 224A or a comparable product by one of the following:
 - a. Armstrong Products, Inc.
 - b. Balco, Inc.
 - c. Nystrom, Inc.
 2. Provide solid-abrasive-type units without ribs.
 3. Nosings: Square-back units, 2 inches wide, without lip, with abrasive filler in contrasting color ADAcompliant.
- B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- C. Apply clear lacquer to concealed surfaces of extruded units set into concrete.

2.13 METAL BAR GRATINGS

- A. Rectangular Bar Grating:
 1. Traffic Surface: As indicated.
 2. Finish: Galvanized.
 3. Basis of Design: McNichols GW, Welded Rectangular Bar Grating.
- B. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
 1. Provide not less than 4 saddle clips for each grating section composed of rectangular bearing bars 3/16 inch (4.8 mm) or less in thickness and spaced 15/16 inch (24 mm) or more o.c., with each clip designed and fabricated to fit over 2 bearing bars.
 2. Furnish threaded bolts with nuts and washers for securing grating to supports.

- C. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
- D. Do not notch bearing bars at supports to maintain elevation.

2.14 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates.

2.15 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

2.16 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.17 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.18 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with primers specified in Section 09 9113 "Exterior Painting" and primers specified in Section 09 9123 "Interior Painting" unless indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Items Indicated to Receive Primers Specified in Section 09 9600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. 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 racking; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. 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.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. 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.
- D. 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.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.2 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.
- B. Anchor supports for operable partitions overhead doors and overhead grilles securely to, and rigidly brace from, building structure.
- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
 - 1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING METAL BOLLARDS

- A. Do not fill removable bollards with concrete.
- B. Anchor bollards to existing construction with through bolts. Provide four 3/4-inch bolts at each bollard unless otherwise indicated.
 - 1. Embed anchor bolts at least 4 inches in concrete.

3.4 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 INSTALLING METAL BAR GRATINGS

- A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

- C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.6 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field 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 9113 "Exterior Painting" and Section 09 9123 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 05 5100

METAL STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

- Industrial-type stairs with steel grating treads.

B. Related Sections:

- Section 05 5000 "Metal Fabrications" for abrasive strips installed at locations other than in metal stairs.
- Section 05 5213 "Pipe and Tube Railings" for metal railings.
- Section 06 1053 "Miscellaneous Rough Carpentry" for wood blocking for anchoring railings.
- Section 09 2216 "Non-Structural Metal Framing" for metal backing for anchoring railings.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs.
- 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.
- C. Coordinate locations of hanger rods and struts with other work so that they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

1.4 ACTION SUBMITTALS

A. Product Data: For metal stairs and the following:

- Paint products.
- Grout.

B. Sustainable Design Submittals:

- Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

2. **Product Certificates:** For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 3. **Building Product Disclosure Requirements:** To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs that conform to USGBC guidelines and have at least a cradle to gate scope and demonstrates product complies with required Global Warming Potential Baseline.
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Shop Drawings:
1. Include plans, elevations, sections, details, and attachments to other work.
 2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
 3. Include plan at each level.
 4. Indicate profile and dimensions of precast terrazzo treads.
- D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for stairs.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification.
 1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
 2. Protect steel members and packaged materials from corrosion and deterioration.

3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
 - a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 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. [Alfab, Inc.](#)
 2. [American Stair, Inc.](#)
 3. [Lapeyre Stair Inc.](#)
 4. [Pacific Stair Corporation.](#)

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design metal stairs, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
1. Uniform Load: 100 lbf/sq. ft..
 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
 3. Uniform and concentrated loads need not be assumed to act concurrently.
 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.
- C. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. Component Importance Factor: 1.5.
- D. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- E. Sustainability Requirements:
1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.
- F. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section when available.
1. Provide a Product-Specific Type III Environmental Product Declaration (EPD), that meets the following parameters, and documents that each product's Global Warming Potential (GWP) is at least equal to the Carbon Leadership Forum (CLF) BETA Embodied Carbon Baselines dated 2019.11.16 as found on EC3 and as listed below for reference:
 - a. Embodied Carbon (GWP) Baselines: Steel

- 1) Plate Steel 3.0 kg CO₂eq per kg/1.4 kg CO₂eq per lb.
- 2) Structural Steel
 - a) Hot-Rolled – 2.5 kg CO₂eq per kg/ 1.1 kg CO₂eq per lb.
 - b) Hollow – 2.5 kg CO₂eq per kg/ 1.1 kg CO₂eq per lb.
- b. System Boundary: Product Stage A1-A3.
- c. Declared Units: 1 kilogram or 1 pound.
2. Product Category Rules:
 - a. Institut Bauen und Umwelt e.V. PCR for Structural Steels, v.1.0/1.6/1.0, 2017-11-30.
 - b. International EPD System PCR for Basic iron or steel products & special steels, except construction products, v.2.0, 2020-03-27.
 - c. UL Environment PCR for Designated Steel Construction Products, v.2.0, 2020-12-31.
3. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

2.3 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 50 percent.
- C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- E. Uncoated, Cold-Rolled Steel Sheet: ASTM A1008/A1008M, structural steel, Grade 25, unless another grade is required by design loads; exposed.
- F. Uncoated, Hot-Rolled Steel Sheet: ASTM A1011/A1011M, structural steel, Grade 30, unless another grade is required by design loads.
- G. Galvanized-Steel Sheet: ASTM A653/A653M, G90 coating, structural steel, Grade 33, unless another grade is required by design loads.
- H. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- I. Steel Bars for Grating Treads: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.
- J. Wire Rod for Grating Crossbars: ASTM A 510.
- K. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.4 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
 - 1. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for stairs indicated to be galvanized.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting."
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. 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. Basis of Design: Subject to compliance with requirements, provide Duragrout by L&M/Laticrete or a comparable product by one of the following:
 - a. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
- F. For galvanized reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.6 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
 - 3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.
- B. 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.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Weld exposed corners and seams continuously unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
 - 1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
 - 2. Locate joints where least conspicuous.
 - 3. Fabricate joints that will be exposed to weather in a manner to exclude water.
 - 4. Provide weep holes where water may accumulate.

2.7 STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
 - 1. Industrial-Type Stairs: Industrial class.
- B. Stair Framing:
 - 1. Fabricate stringers of steel plates or channels at industrial and service stairs.
 - a. Stringer Size: As required to comply with "Performance Requirements" Article.
 - b. Provide closures for exposed ends of channel and tube stringers.
 - 2. Construct platforms of steel plate, channel or tube headers and miscellaneous framing members as needed to comply with performance requirements indicated.
 - a. Provide closures for exposed ends of channel and tube stringers.
 - 3. Weld stringers to headers; weld framing members to stringers and headers.
 - 4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below.

- a. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.
- 5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."
 - 1. Fabricate treads and platforms from welded or pressure-locked steel grating with openings in gratings no more than 1/2 inch in least dimension.
 - 2. Surface: Serrated.
 - 3. Finish: Galvanized.
 - 4. Fabricate grating treads with cast abrasive nosing and with steel angle or steel plate carrier at each end for stringer connections. Secure treads to stringers with bolts.
 - 5. Fabricate grating platforms with nosing matching that on grating treads. Provide toeplates at open-sided edges of grating platforms. Weld grating to platform framing.

2.8 STAIR RAILINGS

- A. Comply with applicable requirements in Section 05 5123 "Pipe and Tube Railings."

2.9 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal stairs after assembly.
- C. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 - 2. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:
 - 1. Exterior Stairs: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interior Stairs: SSPC-SP 3, "Power Tool Cleaning."
- E. Apply shop primer to uncoated surfaces of metal stair components, except those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
 - 1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
 - 1. Grouted Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates.
 - a. Clean bottom surface of plates.
 - b. Set plates for structural members on wedges, shims, or setting nuts.
 - c. Tighten anchor bolts after supported members have been positioned and plumbed.
 - d. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - e. Promptly pack grout solidly between bearing surfaces and plates so no voids remain.
 - 1) Neatly finish exposed surfaces; protect grout and allow to cure.
 - 2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints.
 - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
 - 2. 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.
 - 3. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting."

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 05 5213

PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Steel railings.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. 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.

1.4 ACTION SUBMITTALS

- A. Product Data:
1. Manufacturer's product lines of mechanically connected railings.
2. Fasteners.
3. Post-installed anchors.
4. Handrail brackets.
5. Shop primer.
6. Intermediate coats and topcoats.
7. Bituminous paint.
8. Nonshrink, nonmetallic grout.
9. Anchoring cement.
10. Metal finishes.
11. Paint products.
- B. Sustainable Design Submittals:
1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
a. Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs that conform to USGBC guidelines and have at least a cradle to gate scope

and demonstrates product complies with required Global Warming Potential Baseline.

- b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- D. Samples for Initial Selection: For products involving selection of color, texture, or design, including mechanical finishes.
- E. Samples for Verification: For each type of exposed finish required.
1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
 2. Fittings and brackets.
 3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
 - a. Show method of connecting and finishing members at intersections.
- F. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For delegated-design professional engineer and testing agency.
- B. Welding certificates.
- C. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.
- D. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design railings, including attachment to building construction.

- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Handrails and Top Rails of Guards:
 - 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.
 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- D. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- E. Sustainability Requirements:
1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.
- F. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section when available.
1. Provide a Product-Specific Type III Environmental Product Declaration (EPD), that meets the following parameters, and documents that each product's Global Warming Potential (GWP) is at least 50% better than the Carbon Leadership Forum (CLF) BETA Embodied Carbon Baselines dated 2019.11.16 as found on EC3 and as listed below for reference:
 - a. Embodied Carbon (GWP) Baselines: Steel
 - 1) Rebar – 2.0 kg CO₂eq per kg/.91 kg CO₂eq per lb.
 - 2) Wire & Mesh – 3.0 kg CO₂eq per kg/ 1.4 kg CO₂eq per lb.
 - 3) Plate Steel 3.0 kg CO₂eq per kg/1.4 kg CO₂eq per lb.
 - 4) Structural Steel
 - a) Hot-Rolled – 2.5 kg CO₂eq per kg/ 1.1 kg CO₂eq per lb.
 - b) Hollow – 2.5 kg CO₂eq per kg/ 1.1 kg CO₂eq per lb.
 - 5) Cold Formed Steel – 3.0 kg CO₂eq per kg/ 1.4 kg CO₂eq per lb.
 - b. System Boundary: Product Stage A1-A3.
 - c. Declared Units: 1 kilogram or 1 pound.
 2. Product Category Rules:
 - a. Institut Bauen und Umwelt e.V. PCR for Structural Steels, v.1.0/1.6/1.0, 2017-11-30.
 - b. Institut Bauen und Umwelt e.V. PCR for Thin walled profiles and profiled panels of metal, v.1.0/1.7/1.0, 2019-01-08
 - c. International EPD System PCR for Basic iron or steel products & special steels, except construction products, v.2.0, 2020-03-27.
 - d. UL Environment PCR for Designated Steel Construction Products, v.2.0, 2020-12-31.
 3. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

2.2 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.

2.3 STEEL RAILINGS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- B. Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- C. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
- D. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.4 FASTENERS

- A. Fastener Materials:
 - 1. Ungalvanized-Steel Railing Components: Plated steel fasteners complying with ASTM F1941, Class Fe/Zn 5 for zinc coating.
 - 2. Hot-Dip Galvanized Railing Components: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
 - 3. Finish exposed fasteners to match appearance, including color and texture, of railings.
- 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 of construction 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.
- D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
 - 1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

- A. Handrail Brackets: Cast-iron center of handrail 2-1/2 inches (63.5 mm) from face of railing.
- B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.
- C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- F. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- G. Intermediate Coats and Topcoats: Provide products that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- H. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.
- I. Bituminous Paint: Cold-applied asphalt emulsion, complying with ASTM D1187/D1187M.
- J. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.
 - 1. Basis of Design: Subject to compliance with requirements, provide DuragROUT by L&M/Laticrete or a comparable product by one of the following:
 - a. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
- K. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: At exterior locations and where indicated 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.

2.6 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.
 - 1. Clearly mark units for reassembly and coordinated installation.
 - 2. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
 2. 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.
 1. Provide weep holes where water may accumulate.
 2. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- 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 welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
- I. Form changes in direction as follows:
- J. Retain Form changes in direction as follows:
 1. By bending or by inserting prefabricated elbow fittings.
- K. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.
- M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
 1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
 2. Coordinate anchorage devices with supporting structure.
- P. For railing posts set in concrete, provide stainless 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.

- Q. For removable railing posts, fabricate slip-fit sockets from stainless steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height.
 - 1. Provide socket covers designed and fabricated to resist being dislodged.
 - 2. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.
- R. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
 - 2. Comply with ASTM A123/A123M for hot-dip galvanized railings.
 - 3. Comply with ASTM A153/A153M for hot-dip galvanized hardware.
 - 4. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 - 5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner and as follows.
 - 1. Comply with SSPC-SP 16.
- D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, hot-dip galvanize anchors to be embedded in exterior concrete or masonry.
- E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3.
- F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 - 1. Shop prime uncoated railings with primers specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" unless indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing railings.
 - 1. Fit exposed connections together to form tight, hairline joints.
 - 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.

3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 4. 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.
 5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. 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.
- B. Expansion Joints: Install expansion joints at locations indicated but 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.

3.4 ANCHORING POSTS

- A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Cover anchorage joint with flange of same metal as post, attached to post with setscrews.
- C. Anchor posts to metal surfaces with flanges, angle type, or floor type, as required by conditions, connected to posts and to metal supporting members as follows:
 1. For steel railings, weld flanges to post and bolt to metal supporting surfaces.
- D. Install removable railing sections, where indicated, in slip-fit stainless steel sockets cast in concrete.

3.5 ATTACHING RAILINGS

- A. Anchor railing ends to concrete and masonry with brackets on underside of rails connected to railing ends and anchored to wall construction with anchors and bolts.
- B. Attach handrails to walls with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.
 1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements, using self-tapping screws of size and type required to support structural loads .

3.6 CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

3.7 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.
- B. 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.

END OF SECTION

SECTION 06 1053

MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Rooftop equipment bases and support curbs.
2. Wood blocking, cants, and nailers.
3. Wood furring and grounds.
4. Wood sleepers.
5. Plywood backing panels.
6. Shear panel sheathing.

B. Related Requirements:

1. Section 06 1600 "Sheathing."

1.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

- B. Sustainable Design Submittals:
1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 3. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
 4. Chain-of-Custody Qualification Data: For manufacturer and vendor.
 5. Product Data: Laboratory test reports for products containing composite wood or agrifiber products or wood glues, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 6. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 7. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs that conform to USGBC guidelines and have at least a cradle to gate scope and demonstrates product complies with required Global Warming Potential Baseline.
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

1.5 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
1. Preservative-treated wood.
 2. Fire-retardant-treated wood.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
- B. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body and is a certified participant in AWI's Quality Certification Program.
- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- B. **Building Product Disclosure Requirements:** Provide Building Product Disclosure documentation for products used in this section.
 - 1. Provide a Product-Specific Type III Environmental Product Declaration (EPD), that meets the following parameters, and documents that each product's Global Warming Potential (GWP) is at least 50% better than the Carbon Leadership Forum (CLF) BETA Embodied Carbon Baselines dated 2019.11.16 as found on EC3 and as listed below for reference:
 - a. Embodied Carbon (GWP) Baselines: Wood
 - 1) Dimension Lumber – 100 kg CO₂eq per m³/ 80 kg CO₂eq per yd³
 - a) Wood Framing
 - 2) Composite Lumber – 400 kg CO₂eq per m³/ 310 kg CO₂eq per yd³
 - b. System Boundary: Product Stage A1-A3.
 - c. Declared Units: 1 meter or 1 cubic meter/ 1 foot or cubic yard.
 - d. Product Category Rules:
 - 1) ASTM International PCR for North American Pressure-treated Wood Products, v.1, 2016-06-29
 - 2) SCS Global Services PCR for Roundwood, v.1, 2016-10-18
 - 3) Institut Bauen und Umwelt e.V. PCR for Wood based panels, v.1.0/1.7/1.1, 2019-01-07.
 - 4) UL Environment PCR for North American Structural and Architectural Wood Products, v.1, 2019-10-21.
 - 2. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. **Low-emitting requirements – Interior Products**
 - 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- D. **Additional Low-emitting requirements – Adhesives and Sealants:**
 - 1. Do not use adhesives that contain urea formaldehyde.
 - 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- E. **Low-emitting requirements – Composite Wood:**
 - 1. Composite Wood Evaluation - Composite wood, as defined by the California Air Resources Board, Airborne Toxic Measure to Reduce Formaldehyde Emissions from Composite Wood Products Regulation, shall be documented to have low formaldehyde emissions which meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
- F. **Certified Wood:** Lumber and plywood shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.

G. Sustainability Requirements:

1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.
- H. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded 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.
 3. Provide dressed lumber, S4S, unless otherwise indicated.
- I. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or 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.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
- D. Application: Treat items indicated on Drawings, and the following:
1. Wood canters, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 2. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- 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.

- 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 E 84, 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. Use treatment that does not promote corrosion of metal fasteners.
 - 2. 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 D 2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
- E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat items indicated on Drawings, and the following:
 - 1. Concealed blocking.
 - 2. Roof framing and blocking.
 - 3. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
 - 4. Plywood backing panels.

2.4 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.
 - 5. Furring.
 - 6. Grounds.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.

1. Hem-fir (north); NLGA.
 2. Mixed southern pine or southern pine; SPIB.
 3. Spruce-pine-fir; NLGA.
 4. Hem-fir; WCLIB or WWPA.
 5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
 6. Northern species; NLGA.
- C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
1. Mixed southern pine, No. 2 grade; SPIB.
 2. Hem-fir or hem-fir (north), Standard or No. 3 Common grade; NLGA, WCLIB, or WWPA.
 3. Eastern softwoods, No. 3 Common grade; NELMA.
 4. Northern species, No. 3 Common grade; NLGA.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exterior, AC, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.6 SHEAR PANEL SHEATHING

- A. **Basis-of-Design Product:** Subject to compliance with requirements, provide Sure-Board® Series 200 Structural Panels or comparable product by one of the following:
1. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
- B. Finish: 5/8 thick square or tapered-edge Type X Fire Rated gypsum wallboard complying with ASTM C 1369, laminated with water soluble adhesive to steel sheet.
- C. Steel sheet: No. 22 gage /0.027 inch (0.686 mm) minimum base-metal thickness, complying with ASTM A 653 CS, Grade 33, and is provided with G40 minimum hot-dipped galvanized coating conforming with ASTM A 924.
- D. Fasteners: As recommended by manufacturer.

2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preserved treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.
- D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or ICC-ES AC193 as appropriate for the substrate.
 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 2. Where required for compatibility with wood treatment:
 - a. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.
- F. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or ICC-ES AC193 as appropriate for the substrate.
 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 2. Where required for compatibility with wood treatment:
 - a. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.8 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. [Cleveland Steel Specialty Co.](#)
 2. [KC Metals Products, Inc.](#)
 3. [Phoenix Metal Products, Inc.](#)
 4. [Simpson Strong-Tie Co., Inc.](#)
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
 1. Use for interior locations unless otherwise indicated.
- C. Stainless-Steel Sheet: ASTM A 666, Type 304.
 1. Use for exterior locations and where indicated.

2.9 MISCELLANEOUS MATERIALS

- A. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
 1. Adhesives: Do not use adhesives that contain urea formaldehyde.
 2. Basis of Design: Subject to compliance with requirements, provide Titebond Original wood glue by Franklin International or a comparable product by one of the following:
 - a. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers,

subject to the conditions specified in Division 1 Section Product Substitution Procedures.

- B. 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.
- C. 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.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Metal Framing Anchors: 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. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
 - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

- H. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- J. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- K. Securely attach 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.
 - 2. ICC-ES evaluation report for fastener.
- L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size furring horizontally and vertically at 24 inches o.c.
- C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal-size furring vertically at 16 inches o.c.

3.4 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 miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 06 4023

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior standing and running trim.
2. Wood Cabinets for Transparent Finish
3. Closet and utility shelving.
4. Wood furring, blocking, shims, and hanging strips for installing interior architectural woodwork items that are not concealed within other construction.
5. Shop priming of interior architectural woodwork.
6. Shop finishing of interior architectural woodwork.

B. Related Requirements:

1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing interior architectural woodwork that are concealed within other construction before interior architectural woodwork installation.
2. Section 12 3600 "Countertops".

1.3 COORDINATION

- A. 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.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.6 ACTION SUBMITTALS

A. Product Data: For the following:

1. Anchors.
2. Adhesives.
3. Shop finishing materials.
4. Fire-Retardant Treatment: Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

5. Waterborne Treatments: For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
- B. Sustainable Design Submittals:
 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 3. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
 4. Chain-of-Custody Qualification Data: For manufacturer and vendor.
 5. Product Data: Laboratory test reports for products containing composite wood or agrifiber products or wood glues, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 6. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 7. Product Data: For paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 8. Product Data: Laboratory test reports for ceilings, walls, acoustical and thermal insulation, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 9. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs that conform to USGBC guidelines and have at least a cradle to gate scope and demonstrates product complies with required Global Warming Potential Baseline.
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Shop Drawings: For interior architectural woodwork.
 1. Include plans, elevations, sections, and attachment details.
 2. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.
 3. Show locations and sizes of cutouts and holes for items installed in architectural cabinets.
 4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
 5. Apply WI Quality Certification Program label to Shop Drawings.
- D. Samples for Initial Selection: For each type of exposed finish.
- E. Samples for Verification: For the following:
 1. Lumber for Transparent Finish: Not less than 5 inches wide by 24 inches long, for each species and cut, finished on one side and one edge.
 2. Veneer Leaves: Representative of and selected from flitches to be used for transparent-finished interior architectural woodwork.
 3. 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 finish as specified.

4. Lumber and Panel Products with Shop-Applied Opaque Finish: 5 inches wide by 12 inches long for lumber and 12 by 12 inches for panels, for each finish system and color.
 - a. Finish one-half of exposed surface.
5. Corner Pieces:
 - a. Cabinet-front frame joints between stiles and rails and at exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
 - b. Miter joints for standing trim.
6. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and Installer.
- B. Product Certificates: For each type of product including the following:
 1. Composite wood and agrifiber products.
 2. Glass.
 3. Adhesives.
- C. Evaluation Reports: For preservative-treated and fire-retardant-treated wood materials, from ICC-ES.
- D. Quality Standard Compliance Certificates: WI Quality Certification Program certificates.
- E. Field quality-control reports.

1.8 QUALITY ASSURANCE

- A. Fabricator and Manufacturer Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
 1. Shop Certification: WI's Quality Certification Program accredited participant.
- B. Installer Qualifications: WI's Quality Certification Program accredited participant.
- C. **Manufacturer Qualifications:** A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body and is a certified participant in WI's Quality Certification Program.
- D. **Vendor Qualifications:** A vendor that is certified for chain of custody by an FSC-accredited certification body.
- E. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 1. Build mockups of typical interior architectural woodwork as shown on Drawings.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Architectural Woodwork Standards, Section 2.
- B. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.

- C. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
 1. Handle and store fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.
- C. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.11 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 INTERIOR ARCHITECTURAL WOODWORK, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
 1. Provide inspections of fabrication and installation together with labels and certificates from AWI certification program indicating that woodwork complies with requirements of grades specified.
 2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.
- B. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- C. **Building Product Disclosure Requirements:** Provide Building Product Disclosure documentation for products used in this section where available.
 1. Provide a Product-Specific Type III Environmental Product Declaration (EPD), that meets the following parameters, and documents that each product's Global Warming Potential (GWP) is at least equal to the Carbon Leadership Forum (CLF) BETA Embodied Carbon Baselines dated 2019.11.16 as found on EC3 and as listed below for reference:

- a. Embodied Carbon (GWP) Baselines: Wood
 - 1) Dimension Lumber – 100 kg CO₂eq per m³/ 80 kg CO₂eq per yd³
 - a) Wood Framing
 - 2) Composite Lumber – 400 kg CO₂eq per m³/ 310 kg CO₂eq per yd³
- b. System Boundary: Product Stage A1-A3.
- c. Declared Units: 1 meter or 1 cubic meter/ 1 foot or cubic yard.
- d. Product Category Rules:
 - 1) ASTM International PCR for North American Pressure-treated Wood Products, v.1, 2016-06-29
 - 2) SCS Global Services PCR for Roundwood, v.1, 2016-10-18
 - 3) Institut Bauen und Umwelt e.V. PCR for Wood based panels, v.1.0/1.7/1.1, 2019-01-07.
 - 4) UL Environment PCR for North American Structural and Architectural Wood Products, v.1, 2019-10-21.
2. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

D. Low-emitting requirements – Interior Products

1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.

E. Additional Low-emitting requirements – Paints and Coatings:

1. Show compliance with VOC limits as detailed in Section 01 8116 “Low-Emitting Materials Restrictions”

F. Additional Low-emitting requirements – Adhesives and Sealants:

1. Do not use adhesives that contain urea formaldehyde.
2. Show compliance with VOC limits as detailed in Section 01 8116 “Low-Emitting Materials Restrictions”.

G. Low-emitting requirements – Composite Wood:

1. Composite Wood Evaluation - Composite wood, as defined by the California Air Resources Board, Airborne Toxic Measure to Reduce Formaldehyde Emissions from Composite Wood Products Regulation, shall be documented to have low formaldehyde emissions which meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.

H. Certified Wood: Lumber and plywood shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.

I. Additional Low-emitting requirements –Thermal and Acoustic Insulation

1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
2. Methylene chloride and perchloroethylene shall not be intentionally added in insulation products.

J. Sustainability Requirements:

1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

- A. Grade: Premium.
- B. Hardwood Lumber:
 - 1. Species: match species of adjacent woodwork.
 - 2. Cut: Rift cut/rift sawn.
 - 3. Wood Moisture Content: 5 to 10 percent.
 - 4. For trim items other than base wider than available lumber, use veneered construction. Do not glue for width.
 - 5. For rails thicker than available lumber, use veneered construction. Do not glue for thickness.

2.3 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

- A. Grade: Custom.
- B. Wood Species: Any closed-grain hardwood or MDF where indicated.
 - 1. Wood Moisture Content: 5 to 10 percent.

2.4 WOOD CABINETS FOR TRANSPARENT FINISH

- A. Grade: Premium.
- B. Type of Construction: Frameless.
- C. Door and Drawer Front Interface Style: Flush overlay.
- D. Wood for Exposed Surfaces:
 - 1. Species: Maple.
 - 2. Cut: Rift cut/rift sawn.
 - 3. Grain Direction: Vertically for drawer fronts, doors, and fixed panels.
 - 4. Veneer Matching:
 - a. Veneer Leaves: Slip match.
 - b. Within Panel Faces: Balance match within panel face.
 - c. Cabinet veneers in each space from a single flitch.
 - 5. Shelving: $\frac{3}{4}$ inch unless otherwise noted.
- E. Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: Compatible species to that indicated for exposed surfaces, stained to match.
 - 2. Drawer Subfronts, Backs, and Sides: Solid-hardwood lumber.
 - 3. Drawer Bottoms: Hardwood plywood.
- F. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- G. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

2.5 CLOSET AND UTILITY SHELVING

- A. Grade: Custom.

- B. Closet Shelving: Made from one of the following material, 3/4 inch thick.
1. MDO softwood plywood with solid-wood edge.

- C. Clothes Rods: Chrome-plated steel tubes.

2.6 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.
1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
 2. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.
1. Recycled Content of MDF and Particleboard: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
 2. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
 - a. Basis of Design: "Medite" 3/4 inch thick, by Roseburg.
 3. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
 4. Softwood Plywood: DOC PS 1, medium-density overlay.
 5. Hardwood Veneer Plywood: HPVA HP-1, Non-toxic, urea formaldehyde free: with soy-based adhesive:
 - a. Basis of Design: Purebond by Columbia Forest Products Inc.
 6. Fire Rated Plywood FR plywood at secure walls and where noted: Either DOC PS 1 or DOC PS 2, Exposure 1 sheathing.
 - a. Nominal Thickness: Not less than 1 1/8 inches and as indicated.
 7. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.7 PRESERVATIVE-TREATED-WOOD MATERIALS

- A. Preservative-Treated-Wood Materials: Provide with water-repellent preservative treatment complying with AWPA N1 (dip, spray, flood, or vacuum-pressure treatment).
1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC), combined with a compatible EPA-registered insecticide.
 2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
- B. Extent of Preservative-Treated Wood Materials: Treat interior architectural woodwork in contact with concrete or masonry.
1. Items fabricated from the following wood species need not be treated:
 - a. Redwood.
 - b. Western red cedar.
 - c. White oak.
 - d. African mahogany.
 - e. Honduras mahogany.
 - f. Ipe.
 - g. Dark red meranti.

h. Teak.

2.8 FIRE-RETARDANT-TREATED WOOD MATERIALS

- A. Fire-Retardant-Treated Wood Materials, General: Where fire-retardant-treated materials are indicated, use materials complying with requirements 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.
 1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
- B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, 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. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
 2. For items indicated to receive a stained, transparent, or natural finish, use organic resin chemical formulation.
 3. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
- C. Fire-Retardant Fiberboard: Medium-density fiberboard (MDF) panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Panel Source International, Inc., McKillican America, Inc.; Pyroblock Platinum.
 - b. Roseburg, Medite FR.

2.9 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 08 7100 "Door Hardware."
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing.
- C. Back-Mounted Pulls: BHMA A156.9, B02011.
- D. Wire Pulls: Back mounted, solid metal, 5 inches long, 2-1/2 inches deep, and 5/16 inch in diameter.
- E. Catches: Magnetic catches, BHMA A156.9, B03141.
- F. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04102; with shelf brackets, B04112.

- G. Shelf Rests: BHMA A156.9, B04013; metal.
- H. Drawer Slides: ANSI/BHMA A156.9.
 - 1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer.
 - a. Type: Full extension.
 - b. Material: Zinc-plated steel with polymer rollers.
 - 2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel, ball-bearing slides.
 - 3. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
 - 4. For drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
 - 5. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.
 - 6. For computer keyboard shelves, provide Grade 1HD-100.
 - 7. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-200.
- I. Door Locks: BHMA A156.11, E07121.
- J. Drawer Locks: ANSI/BHMA A156.11, E07041.
- K. Door and Drawer Silencers: BHMA A156.16, L03011.
- L. Tempered Float Glass for Cabinet Doors: ASTM C1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3, 6 mm thick unless otherwise indicated.
 - 1. Unframed Glass Doors: Seam exposed edges seamed before tempering.
- M. Tempered Float Glass for Cabinet Shelves: ASTM C1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3; with exposed edges seamed before tempering, 6 mm thick.
- N. Grommets for Cable Passage: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.
 - 1. Color: Black.
 - 2. Acceptable manufacturer:
 - a. Doug Mockett & Co, Inc.
- O. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Stainless Steel: ANSI/BHMA 630.
- P. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.10 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Nailers: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.
 - 1. Preservative Treatment: Provide softwood lumber treated by pressure process, AWPA U1; Use Category UC3b.
 - a. Provide where in contact with concrete or masonry.
 - b. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
 - c. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - d. Mark lumber with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee's (ALSC) Board of Review.

2. Fire-Retardant Treatment: Complying with requirements; provide where indicated.
- B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.
- C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- D. **Adhesives:** Do not use adhesives that contain urea formaldehyde.
 1. Basis of Design: Subject to compliance with requirements, provide Titebond Original wood glue by Franklin Internationsl or a comparable product by one of the following:
 - a. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
- E. Adhesive for Bonding Plastic Laminate: PVA.
 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.11 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 1. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
 2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
- C. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.
 1. Ease edges to radius indicated for the following:
 - a. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
- 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.
- E. Install glass to comply with applicable requirements in Section 088000 "Glazing" and in GANA's "Glazing Manual."
 1. For glass in frames, secure glass with removable stops.
 2. For exposed glass edges, polish and grind smooth.
- F. Core Material:
 1. Horizontal surfaces: All hardwood veneer core plywood
 2. Vertical Surfaces: All hardwood veneer core plywood or MDF 40 at Contractor's option.
 3. Vertical Surface with flame spread requirements: Fire-Retardant Fiberboard.
 4. Doors: Provide solid bearing for hinges.

2.12 SHOP FINISHING

- A. General: Finish interior architectural woodwork with transparent finish at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.

- B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.
1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of interior architectural woodwork. Apply two coats to end-grain surfaces.
- C. Transparent Finish:
1. Grade: Same as item to be finished.
 2. Finish: System - 2, precatalyzed lacquer 3, postcatalyzed lacquer or 5, conversion varnish.
 3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
 4. Staining: Match Architect's sample.
 5. Sheen: Semigloss, 46-60 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition interior architectural woodwork to average prevailing humidity conditions in installation areas.
- B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.
- B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install interior architectural woodwork level, plumb, true in line, and without distortion.
 1. Shim as required with concealed shims.
 2. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Preservative-Treated Wood: Where cut or drilled in field, treat cut ends and drilled holes according to AWPA M4.
- F. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- G. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.
 1. Secure with countersunk, concealed fasteners and blind nailing.
 2. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with interior architectural woodwork.
 3. For shop-finished items, use filler matching finish of items being installed.

- H. Standing and Running Trim:
1. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
 2. Do not use pieces less than 60 inches long, except where shorter single-length pieces are necessary.
 3. Scarf running joints and stagger in adjacent and related members.
 4. Fill gaps, if any, between top of base and wall with plastic wood filler; sand smooth; and finish same as wood base if finished.
 5. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

3.3 INSTALLATION – CABINETS

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with cabinet surface.
 1. For shop-finished items, use filler matching finish of items being installed.
- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.
 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 2. Install cabinets without distortion so doors and drawers fit openings 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.
 3. Maintain veneer sequence matching of cabinets with transparent finish.
 4. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

3.4 FIELD QUALITY CONTROL

- A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
 1. Inspection entity shall prepare and submit report of inspection.

3.5 REPAIR

- A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects and to result in interior architectural woodwork being in compliance with requirements of Architectural Woodwork Standards for the specified grade.
- B. Where not possible to repair, replace defective woodwork.

- C. Shop Finish: Touch up finishing work specified in this Section after installation of interior architectural woodwork.
 - 1. Fill nail holes with matching filler where exposed.
 - 2. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.
- D. Field Finish: See Section 099123 "Interior Painting" for final finishing of installed interior architectural woodwork not indicated to be shop finished.

3.6 CLEANING

- A. Clean interior architectural woodwork on exposed and semiexposed surfaces.
- B. Clean, lubricate, and adjust hardware.

END OF SECTION

SECTION 07 2100

BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Mineral-wool blanket insulation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
4. Product Data: Laboratory test reports for acoustical and thermal insulation, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
5. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs that conform to USGBC guidelines and have at least a cradle to gate scope and demonstrates product complies with required Global Warming Potential Baseline.
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- B. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- B. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section.
1. Provide a Product-Specific Type III Environmental Product Declaration (EPD), that meets the following parameters, and documents that each product's Global Warming Potential (GWP) is at least the Carbon Leadership Forum (CLF) BETA Embodied Carbon Baselines dated 2019.11.16 as found on EC3 and as listed below for reference:
 2. Embodied Carbon (GWP) Baselines:
 - a. Board – 100 kgCO₂ eq per M²-Rsi/ 9 kgCO₂ eq per ft²-R5.68
 - b. Blanket – 8 kgCO₂ eq per M²-Rsi/ 0.7 kgCO₂ eq per ft²-R5.68
 - c. Foamed-in-Place – 60 kgCO₂ eq per M²-Rsi/ 6 kgCO₂ eq per ft²-R5.68
 - d. Blown – 8 kgCO₂ eq per M²-Rsi/ 0.7 kgCO₂ eq per ft²-R5.68
 3. System Boundary: Product Stage A1-A3.
 4. Declared Units: 1 square meter with thickness so that R_SI (average thermal resistance) = 1 m²K/W.
 5. Product Category Rules:
 - a. UL Environment PCR for Building Envelope Thermal Insulation, v.2, 2018-04-10.
 - b. UL Environment PCR for Calculation Rules for the LCA and Requirements on the Project Report, v3.2, 2018-12-11.
 - c. Institut Bauen und Umwelt e.V. PCR for Mineral insulating materials, v1.1, 2018-12-11.
 - d. Institut Bauen und Umwelt e.V. PCR for Calculation Rules for the LCA and Requirements on the Project Report, v1.3, 2014-06-19.
 6. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Low-emitting requirements – Interior Products
1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.

- D. Additional Low-emitting requirements – Adhesives and Sealants:
1. Do not use adhesives that contain urea formaldehyde.
 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- E. Additional Low-emitting requirements –Insulation within the weatherproofing barrier:
1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
 2. Methylene chloride and perchloroethylene shall not be intentionally added in insulation products.
- F. Sustainability Requirements:
1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.

2.2 MINERAL-WOOL BLANKET ACOUSTIC INSULATION

- A. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
1. Acoustic Performance at 1-1/2inch: NRC 0.85
 2. Thickness: as required for STC rating indicated.
- B. Basis of Design: Subject to compliance with requirements, provide one of the following:
1. AFB EVO by Rockwool Inc
 2. Owens Corning - Thermafiber UltraBatt FF
 3. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
- C. Sustainability Requirements: Provide Mineral-Wool Blanket insulation as follows:
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

2.3 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.
- B. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of 2 inches between face of insulation and substrate to which anchor is attached.
- C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.
- B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation.

3.4 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

- A. Where glass-fiber blankets are indicated for above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions.

3.5 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07 6200

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manufactured reglets with counterflashing.
2. Formed wall sheet metal fabrications.
3. Formed equipment support flashing.
4. Formed overhead-piping safety pans.

B. Related Requirements:

1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.

1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
 3. Review requirements for insurance and certificates if applicable.
 4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Sustainable Design Submittals:

1. **Product Data:** For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 2. **Product Certificates:** For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 3. **Building Product Disclosure Requirements:** To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations:
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Shop Drawings: For sheet metal flashing and trim.
1. Include plans, elevations, sections, and attachment details.
 2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
 3. Include identification of material, thickness, weight, and finish for each item and location in Project.
 4. Include details for forming, including profiles, shapes, seams, and dimensions.
 5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 6. Include details of termination points and assemblies.
 7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
 8. Include details of roof-penetration flashing.
 9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 10. Include details of special conditions.
 11. Include details of connections to adjoining work.
 12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.
- D. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.
- E. Samples for Verification: For each type of exposed finish.
1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
 2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
 3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested and FM Approvals approved.
- C. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- D. Evaluation Reports: For copings and roof edge flashing, from an agency acceptable to authority having jurisdiction showing compliance with ANSI/SPRI/FM 4435/ES-1.

E. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Mockups: Install sheet metal flashing and trim in mockups of assemblies specified in other Sections that are indicated to receive products specified in this Section. Use materials and installation methods specified in this Section.
1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
 2. Protect stored sheet metal flashing and trim from contact with water.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:
1. Design Pressure: As indicated on Drawings.

- D. Recycled Content of Steel-Sheet Flashing and Trim: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- F. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- G. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 - 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.
- H. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section when available.
 - 1. Environmental product Declarations:
 - 2. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed; with smooth, flat surface.
 - 1. Finish: 2B (bright, cold rolled).

2.3 UNDERLayment MATERIALS

- A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.
- B. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
 - 1. Basis of Design: Subject to compliance with requirements, provide [Henry Company](#), Blueskin PE200 HT, or a comparable product by one of the following:
 - a. [Carlisle Residential, a division of Carlisle Construction Materials](#); WIP 300HT.
 - b. [Grace Construction Products, a unit of W. R. Grace & Co.-Conn.](#) Ultra
 - c. [Metal-Fab Manufacturing, LLC](#); MetShield.
 - d. [Owens Corning](#); WeatherLock Specialty Tile & Metal Underlayment.
 - 2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.

3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.
- C. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength stainless-steel rivets suitable for metal being fastened.
 2. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- C. Solder:
 1. For Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
- I. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
 1. Basis of Design: Subject to compliance with requirements, provide [products by Hohmann & Barnard, Inc.](#) or a comparable product by one of the following:
 - a. [Fry Reglet Corporation](#).
 - b. [Heckmann Building Products, Inc.](#)
 - c. [Hickman Company, W. P.](#)
 - d. [Keystone Flashing Company, Inc.](#)
 - e. [National Sheet Metal Systems, Inc.](#)

2. Material: Stainless steel, 0.019 inch thick.
3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
4. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
5. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
6. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
7. Accessories:
 - a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
 - b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
8. Finish: Mill.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 3. Obtain field measurements for accurate fit before shop fabrication.
 4. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances:
 1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
 2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- F. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

2.6 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot-long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch-high, end dams. Fabricate from the following materials:
 1. Stainless Steel: 0.016 inch thick.
- B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:
 1. Stainless Steel: 0.016 inch thick.

2.7 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:
 1. Stainless Steel: 0.019 inch thick.
- B. Overhead-Piping Safety Pans: Fabricate from the following materials:
 1. Stainless Steel: 0.025 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 1. Verify compliance with requirements for installation tolerances of substrates.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLayment INSTALLATION

- A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim.
 1. Install in shingle fashion to shed water.
 2. Lap joints not less than 2 inches (**50 mm**).
- B. Self-Adhering, High-Temperature Sheet Underlayment:
 1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
 2. Prime substrate if recommended by underlayment manufacturer.

3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
 4. 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.
 5. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller.
 6. Roll laps and edges with roller.
 7. Cover underlayment within 14 days.
- C. Install slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.
1. Install in shingle fashion to shed water.
 2. Lapp joints not less than 4 inches (100 mm).

3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
1. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 3. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 4. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
 5. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 6. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 7. Torch cutting of sheet metal flashing and trim is not permitted.
 8. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
 - 1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 07 9200 "Joint Sealants."
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
 - 1. Do not use torches for soldering.
 - 2. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 - 3. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

3.4 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 04 2000 "Unit Masonry."
- C. Reglets: Installation of reglets is specified in Section 03 3000 "Cast-in-Place Concrete."
- D. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.5 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.
- B. Overhead-Piping Safety Pans: Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.

3.6 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.

3.8 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- B. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 8413

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

- B. Related Requirements:

1. Section 07 8443 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 REFERENCES

- A. The following publications govern the work of this Section and are hereby incorporated in the Contract Documents as if bound herein. The standards described apply generally unless specifically indicated otherwise in the text. They are identified below by their publishers and are referred to in the text by basic designation only.

1. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
ASTM E 84B91a Surface Burning Characteristics of Building Materials
ASTM E 814B88 Fire Tests of Through-Penetration Fire Stops
ASTM C 1193B91 Guide for Use of Joint Sealants
2. UNDERWRITERS LABORATORIES (UL)
UL-05B92 Fire Resistance Directory
UL 723B93 Test for Surface Burning Characteristics of Building Materials
UL 1479B83 Fire Tests of Through-Penetration Firestops
UL 2079 Tests for Fire Resistance of Building Joint Systems

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.

3. **Product Data:** For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 4. **Building Product Disclosure Requirements:** To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations;
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
- 1.6 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer.
 - B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.
- 1.7 CLOSEOUT SUBMITTALS
- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.
- 1.8 QUALITY ASSURANCE
- A. Installer Qualifications: A firm that has been approved by FM Approval according to FM Approval 4991, "Approval Standard for Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."
- 1.9 PROJECT CONDITIONS
- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
 - B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.
- 1.10 COORDINATION
- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
 - B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek Group in its "Directory of Listed Building Products."
 - 3) FM Global in its "Building Materials Approval Guide."
- B. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- C. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section where available.
 - 1. Environmental Product Declarations:
 - 2. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- D. Low-emitting requirements – Interior Products
 - 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- E. Additional Low-emitting requirements – Adhesives and Sealants:
 - 1. Do not use adhesives that contain urea formaldehyde.
 - 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- F. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 - 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.

2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. [3M Fire Protection Products](#).
 - b. [Hilti, Inc.](#)
 - c. [Tremco, Inc.](#)

- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
 - 2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.
 - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.
- F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
 - 1. Permanent forming/damming/backing materials.
 - 2. Substrate primers.
 - 3. Collars.
 - 4. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.4 MIXING

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

- A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

- C. Install fill materials by proven techniques to produce the following results:
1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.
- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Designation of applicable testing and inspecting agency.
 4. Date of installation.
 5. Manufacturer's name.
 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.
- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION

SECTION 07 9200

JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.
4. Preformed joint sealants.
5. Acoustical joint sealants.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.

- B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
4. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations:
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

- C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

- D. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

- E. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.

2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:
 1. Joint-sealant location and designation.
 2. Manufacturer and product name.
 3. Type of substrate material.
 4. Proposed test.
 5. Number of samples required.
- D. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:
 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.
- E. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- F. Field-Adhesion-Test Reports: For each sealant application tested.
- G. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
 1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.
- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 1. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 2. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with glazing and gasket materials.

3. Stain Testing: Use ASTM C 1248 to determine stain potential of sealant when in contact with masonry substrates.
 4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
 5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
 7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.
- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 2. Conduct field tests for each kind of sealant and joint substrate.
 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.8 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.9 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace 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. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: 20 years from date of Substantial Completion.

- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from 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

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- C. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section where available.
1. Environmental Product Declarations:
 2. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- D. Low-emitting requirements – Interior Products
1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- E. Additional Low-emitting requirements – Adhesives and Sealants:
1. Do not use adhesives that contain urea formaldehyde.
 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- F. Sustainability Requirements:
1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.
- G. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.
1. Sealant materials exposed to view shall match colors of adjacent surfaces.
 - a. Provide custom colors to match Architect's samples.
 2. Provide custom-blended colors as needed for color matching as follows:
 - a. Sealant Joints in Masonry: Match mortar color
 - b. Joints in Cast Stone: Match color of matrix
 - c. Joints Around Doors, Windows, and Openings: Match color of adjacent wall material
 - d. Joints in Tile: Match grout color
 - e. Joints in Floors: Match control sample provided by Architect

3. Fully concealed joints:
 - a. As selected by Architect from manufacturer's full color range which has best overall performance characteristics required for application

2.2 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 790.
 - b. Pecora Corporation; 301 NS, 311 NS, 890, or 890FTS.
 - c. Sika Corporation, Construction Products Division; SikaSil WS-290.
 - d. Tremco Incorporated; Spectrem 1 or Spectrem 800.
- B. Silicone, S, NS, 50 NT: Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 795.
 - b. Pecora Corporation; 864, 895 or 898.
 - c. Sika Corporation, Construction Products Division; SikaSil WS-295.
 - d. Tremco Incorporated; Spectrem 2 or Spectrem 3.

2.3 SELF-LEVELING SILICONE TRAFFICJOINTS

- A. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type SL; ASTM C 920, Type SL, Class 100/50, Use T; jet fuel resistant; gun-grade.
 - a. Tremco Incorporated; Spectrem 900SL.
- B. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type NS; ASTM C 920, Type S, Grade NS, Class 100/50, Use T; gun-grade.
 - a. Tremco Incorporated; Spectrem 800.

2.4 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. STPE, Mildew Resistant, S, NS, NT: Mildew-resistant, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Use NT.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; MasterSeal NP 150.
 - b. Pecora Corporation; 898 NST.
 - c. Tremco Incorporated; Tremsil 200.

2.5 URETHANE JOINT SEALANTS

- A. Urethane, M, NS, 50, T, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Uses T and NT.
 - a. Pecora Corporation; Dynatrol II

- B. Urethane, M, NS, 25, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 25, Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; MasterSeal NP 2.
 - b. Pecora Corporation; Dynatred.
 - c. Sika Corporation, Construction Products Division; Sikaflex 2c NS EZ Mix.
 - d. Tremco Incorporated; Vulkem 227.
- C. Urethane, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 25, Uses T.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; MasterSeal NP 2.
 - b. Pecora Corporation; Dynatred.
 - c. Sika Corporation, Construction Products Division; Sikaflex 2c NS EZ Mix.

2.6 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; AC-20+.
 - b. Pecora Corporation; AC-20 FTR
 - c. Pecora Corporation; AIS 919
 - d. Tremco Incorporated; Tremflex 834.

2.7 PREFORMED JOINT SEALANTS

- A. Preformed Silicone Joint Sealants: Manufacturer's standard seal consisting of precured low-modulus silicone extrusion, with a neutral-curing silicone sealant for bonding extrusions to substrates.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 123 Silicone Seal.
 - b. Pecora Corporation; Sil-Span.
 - c. Tremco Incorporated; Spectrem Simple Seal.
 2. Joint Seal Width: Joint size indicated on Drawings plus 0.75 inch.
 3. Joint Seal Color: As selected by Architect from full range of industry colors.
- B. Preformed, Foam Joint Seals: Manufacturer's standard joint seal manufactured from urethane or EVA (ethylene vinyl acetate) foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths based on design criteria indicated, with factory- or field-applied adhesive for bonding to substrates.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. EMSEAL Joint Systems, Ltd.; Emseal 25V.
 - b. MM Systems Corporation; EIF EIS SIF.
 - c. Tremco Incorporated; ExoAir Eco
 - d. Tremco Incorporated; ExoAir Trio
 - e. Tremco Incorporated; Illmod 600
 2. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Minimum Joint Width: As indicated on Drawings.
 - c. Maximum Joint Width: As indicated on Drawings.
 - d. Movement Capability: -25 percent/+25 percent.

3. Joint Seal Color: As selected by Architect from full range of industry colors.

2.8 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C 834.
- B. Products: Subject to compliance with requirements, provide one of the following:
1. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - b. Pecora Corporation; AIS-919.
 - c. USG Corporation; SHEETROCK Acoustical Sealant.
 2. Acoustical Sealant for Concealed Joints:
 - a. Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.
 - b. Hilti CP605
 - c. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - d. Pecora Corporation; AIS-919.
 - e. Tremco, Inc.; Tremco Acoustical Sealant.
 3. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors.
- C. Sheet caulking for junction boxes:
1. "Lowry's Electrical Box Sealer".
 2. Tremco sheet caulking.
- D. Sheet caulking for junction boxes at fire-rated assemblies:
1. "Firestop Putty Pads" by Hevi-duty/Nelson.
 2. Specified Technologies, Inc.
 3. HILTI CP-617.
- E. Backing Rod: Closed-cell, neoprene rod or polyethylene foam.
- F. Expanding Foam Sealant: UL Class 1 fire retardant - Polycell expanding foam
1. Macklanburg Duncan (800-348-3571)
 2. Great Stuff Pro Gaps & Cracks by Dow.
- G. Cementitious sealant:
1. Spray-applied (40 pcf) Monokote Z-146
- H. Sprayed Acoustical Sealant:
1. STI "SpecSeal Smoke 'N' Sound Acoustical Spray"
 2. Hilti CP672.

2.9 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) Type O (open-cell material) Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.10 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.

- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to

comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
 4. Install all sealants free of contaminated substances, in a uniform, continuous smooth free application without air gaps or voids, regardless of abutting surface profiles. A high level of workmanship and finish is required, as determined by the Architect.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
 4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C 1193.
 5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- G. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.

2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

3.4 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

- A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.
- B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.
- C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.5 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
 4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.

5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.6 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.7 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.8 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior and interior joints in horizontal traffic surfaces.
 1. Joint Sealant: Urethane M NS 25 T.
 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 1. Joint Sealant:
 - a. Silicone S NS 100/50 NT.
 - b. Silicone, S, NS, 50 NT
 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 1. Joint Sealant: Latex OP NF.
 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
 1. Joint Sealant: STPE, Mildew Resistant, S, NS, NT.
 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
 1. Joint Sealant: Acoustical.
 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION

SECTION 08 1113

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes:
 1. Interior standard steel doors and frames.
 2. Exterior standard steel doors and frames.
 3. Copper clad exterior custom steel doors and frames.
 4. Exterior door canopy.

- B. Related Requirements:
 1. Section 08 7100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.
- B. Sustainable Design Submittals:
 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.

3. **Building Product Disclosure Requirements:** To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations;
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Shop Drawings: Include the following:
 1. Elevations of each door type.
 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of each different wall opening condition.
 6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 7. Details of anchorages, joints, field splices, and connections.
 8. Details of accessories.
 9. Details of moldings, removable stops, and glazing.
- D. Samples for Initial Selection: For hollow-metal doors and frames with factory-applied color finishes.
- E. Samples for Verification:
 1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
 2. Fabrication: Prepare Samples approximately 12 by 12 inches to demonstrate compliance with requirements for quality of materials and construction:
 - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
 - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.
 - c. Top corner at head / jamb condition, cut sample to show core.
 - 1) corner sample, 12" each leg, unfinished.
- F. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Subject to compliance with requirements, provide products by [Ceco Door](#); [ASSA ABLOY](#) or a comparable product by one of the following:
1. [Curries Company; ASSA ABLOY](#).
 2. [Fleming Door Products Ltd.; Assa Abloy Group Company](#).
 3. [Steelcraft](#); an Ingersoll-Rand company.

- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.
1. Large-Missile Test: For glazed openings located within 30 feet of grade.
- C. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.40 deg Btu/F x h x sq. ft. when tested according to ASTM C 518.
- D. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- E. Sustainability Requirements:
1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.
- F. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section when available.
1. Environmental product Declarations:
 2. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified
- B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.
 - 1. Physical Performance: Level A according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.053 inch.
 - d. Edge Construction: Model 2, Seamless.
 - e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
 - f. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - g. Fire-Rated Core: Manufacturer's standard vertical steel stiffener core for fire-rated and temperature-rise-rated doors.
 - 3. Frames:
 - a. Materials: Uncoated, steel sheet, minimum thickness of 0.053 inch.
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: Full profile welded unless otherwise indicated.
 - 1) Slip on drywall at in place gypsum board partitions.
 - 4. Exposed Finish: Prime.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Maximum-Duty Doors and Frames: SDI A250.8, Level 4.
 - 1. Physical Performance: Level A according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches
 - c. Face: Zinc-Tin Alloy-Coated Copper Sheet: ASTM B370 cold-rolled copper sheet, H00 temper, coated on both sides with zinc-tin alloy (50 percent zinc, 50 percent tin).
 - 1) **Products:** Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a) **Revere Copper Products, Inc.**; Freedom Gray.
 - 2) Weight (Thickness): 16 oz./sq. ft. uncoated, with 0.787-mil coating thickness applied to each side.
 - d. Edge Construction: Model 2, Seamless.
 - e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
 - f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
 - g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.

- h. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
 - i. Fire-Rated Core: Manufacturer's standard vertical steel stiffener with insulation core for fire-rated doors.
3. Frames:
- a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum A40 coating.
 - b. Construction: Full profile welded.
4. Exposed Finish: Prime.

2.5 COPPER COVERED EXTERIOR CUSTOM STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Maximum-Duty Doors and Frames: SDI A250.8, Level 4.
 - 1. Physical Performance: Level A according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum A40 coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
 - f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
 - g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
 - h. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
 - i. Fire-Rated Core: Manufacturer's standard vertical steel stiffener with insulation core for fire-rated doors.
 - 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum A40 coating.
 - b. Construction: Full profile welded.
 - 4. Exposed Finish: Prime.

2.6 EXTERIOR DOOR CANOPY

- A. Basis of Design: Subject to compliance with requirements, provide Lighted Personnel Door Canopy by Metallic Products or a comparable product by one of the following:
 - 1. Awntech Corporation.
 - 2. C.R.Laurence Co.

3. Mapes Industries
- B. Provide canopy size as indicated on the drawings.
1. 24-gauge flat soffit and integral gutter with rear-mounted drains
 2. 14-gauge galvanized internal frame.
 3. 16-gauge telescoping support channels mount behind wall panel between girts.
- C. Finish: Galvalume.
- 2.7 BORROWED LITES**
- A. Fabricate of uncoated steel sheet, minimum thickness of 0.053 inch.
- B. Construction: Full profile welded.
- C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.
- D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
- 2.8 HOLLOW-METAL PANELS**
- A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.
- 2.9 FRAME ANCHORS**
- A. Jamb Anchors:
1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 4. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
 5. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.
- D. Material: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M; hot-dip galvanized according to ASTM A 153/A 153M, Class B.

2.10 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- E. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- G. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- H. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- I. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- J. Glazing: Comply with requirements in Section 08 8000 "Glazing."
- K. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.11 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
 - 2. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated.
 - 3. Vertical Edges for Single-Acting Doors: Provide square edges.

4. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
 5. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
 6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 7. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - c. Compression Type: Not less than two anchors in each frame.
 - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
 6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- F. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Provide stops and moldings flush with face of door, and with beveled stops unless otherwise indicated.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
 4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
 5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.12 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.13 ACCESSORIES

- A. Provide louvers for interior doors, where indicated, which comply with SDI 111, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.
1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
 2. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.
- B. Form corners of moldings with hairline joints. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
- C. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- D. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.1 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 embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - b. Install frames with removable stops located on secure side of opening.
 - c. Install door silencers in frames before grouting.
 - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - f. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
 2. Fire-Rated Openings: Install frames according to NFPA 80.
 3. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 4. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
 6. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 1. Non-Fire-Rated Steel Doors: Comply with SDI A250.8.
 - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
 - c. At Bottom of Door with no Threshold: 5/8 inch plus or minus 1/32 inch (0.8 mm).
 - d. At Bottom of Door with Threshold: 3/4 inch plus or minus 1/32 inch.

- e. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
 - D. Glazing: Comply with installation requirements in Section 08 8000 "Glazing" and with hollow-metal manufacturer's written instructions.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.
 - E. Exterior Door canopy: install as per manufacturer instructions.
- 3.4 ADJUSTING AND CLEANING**
- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
 - B. Remove grout and other bonding material from hollow-metal work immediately after installation.
 - C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
 - D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
 - E. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
 - F. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

SECTION 08 3113

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Access doors and frames for walls and ceilings.

- B. Related Requirements:

1. Section 07 7200 "Roof Accessories" for roof hatches.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

- B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.

3. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:

- a. Environmental product Declarations:

- b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

- C. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.

2. Detail fabrication and installation of access doors and frames for each type of substrate.

- D. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.

- E. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the

- following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
 2. NFPA 288 for fire-rated access door assemblies installed horizontally.
- B. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following sections:
1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- C. Sustainability Requirements:
1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.
- D. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section when available.
1. Environmental product Declarations:
 2. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

2.2 RECESSED ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. **Manufacturers:** Subject to compliance with requirements, provide product by one of the following:
1. [Babcock-Davis](#).
 2. [J. L. Industries, Inc.; Div. of Activar Construction Products Group](#).
 3. [Larsen's Manufacturing Company](#).
 4. [MIFAB, Inc.](#)
 5. [Milcor](#)
 6. [Nystrom, Inc.](#)
 7. [Williams Brothers](#)
- B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.
- C. Recessed Access Doors:
1. Description: Door face recessed 5/8 inch ([16 mm](#)) for gypsum board infill; with concealed flange and concealed hinge.
 2. Locations: Wall and ceiling.
 3. Door Size: 2 x 2 feet unless otherwise indicated.
 4. Cold-Rolled Steel Sheet:
 - a. Door Material: Nominal 0.062 inch ([1.6 mm](#)), 16 gauge.
 - b. Frame Material: Nominal 0.062 inch ([1.6 mm](#)), 16 gauge. Provide 1/4-inch ([6.35-mm](#)) mounting holes.
 - c. Finish: Paintable White; powder-coat.
 5. Latch and Lock: Cam latch, key operated, with interior release.

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
1. [Babcock-Davis](#).

2. [J. L. Industries, Inc.; Div. of Activar Construction Products Group.](#)
3. [Larsen's Manufacturing Company.](#)
4. [MIFAB, Inc.](#)
5. [Nystrom, Inc.](#)

B. Fire-Rated, Flush Access Doors with Concealed Flanges:

1. Assembly Description: Fabricate door to fit flush to frame, uninsulated. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
2. Locations: Wall and ceiling.
3. Fire-Resistance Rating: Not less than that of adjacent construction.
4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage
 - a. Finish: Factory prime.
5. Frame Material: Same material, thickness, and finish as door.
6. Hinges: Manufacturer's standard.
7. Latch and Lock: Self-closing, self-latching door hardware, operated by knurled-knob, with interior release.

C. Hardware:

1. Latch: Cam latch operated by screwdriver.

2.4 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- C. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- D. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines or blend into finish.
- E. Aluminum Extrusions: ASTM B 221, Alloy 6063.
- F. Aluminum Sheet: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- G. Frame Anchors: Same type as door face.
- H. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.5 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
 - 2. Provide mounting holes in frames for attachment of units to metal or wood framing.
 - 3. Provide mounting holes in frame for attachment of masonry anchors.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
 - 1. For recessed doors with plaster infill, provide self-furring expanded-metal lath attached to door panel.
- E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 - 1. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.
- F. Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

2.6 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. 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.
- D. Steel and Metallic-Coated-Steel Finishes:
 - 1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
- E. Stainless-Steel Finishes:
 - 1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 - 2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - c. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08 3323

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Service doors.

- B. Related Requirements:

1. Section 05 5000 "Metal Fabrications" for miscellaneous steel supports.
2. Section 09 9123 "Interior Painting" for finish painting of factory-primed doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

- B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations:
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

- C. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
5. Include diagrams for power, signal, and control wiring.

- D. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.
 - E. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
 1. Curtain slats.
 2. Bottom bar.
 3. Guides.
 4. Brackets.
 5. Hood.
 6. Locking device(s).
 7. Include similar Samples of accessories involving color selection.
- 1.4 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer.
- 1.5 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.
- 1.6 QUALITY ASSURANCE
- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
- B. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" the ABA standards of the Federal agency having jurisdiction and ICC A117.1.
- 1.7 WARRANTY
- A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS, GENERAL
- A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
 1. Obtain operators and controls from overhead coiling door manufacturer.
- 2.2 PERFORMANCE REQUIREMENTS
- A. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
 1. Design Wind Load: As indicated on Drawings.
 2. Testing: According to ASTM E 330 or DASMA 108 for garage doors and meeting the acceptance criteria of DASMA 108.
 3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
 4. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.

- B. Seismic Performance: Overhead coiling doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Component Importance Factor: 1.5.
- C. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- D. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 - 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.
- E. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section when available.
 - 1. Environmental product Declarations:
 - 2. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

2.3 DOOR ASSEMBLY

- A. Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
 - 1. **Basis-of-Design Product:** Subject to compliance with requirements, provide Rolling Steel Service Doors 610 by [C.H.I. Overhead Doors, Inc.](#) or comparable product by one of the following:
 - a. [Cookson Company](#).
 - b. [Dynamic Closures Corporation](#).
 - c. [Janus International Corporation](#).
 - d. [Lawrence Roll-Up Doors, Inc.](#)
 - e. [McKeon Rolling Steel Door Company, Inc.](#)
- B. Operation Cycles: Door components and operators capable of operating for not less than 100,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
 - 1. Include tamperproof cycle counter.
- C. Air Infiltration: Maximum rate of 1.0 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E 283 or DASMA 105.
- D. Door Curtain Slats: Flat profile slats.
 - 1. Insulated-Slat Interior Facing: Metal.
 - 2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.
- E. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from hot-dip galvanized steel and finished to match door.
- F. Provide Isolation and vibration dampers.
- G. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.
- H. Hood: Match curtain material and finish.
 - 1. Shape: As shown on Drawings.

2. Mounting: As shown on Drawings.
 - I. Electric Door Operator:
 1. Usage Classification: Standard duty, up to 25 cycles per hour and up to 90 cycles per day.
 2. Operator Location: As shown on Drawings.
 3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower.
 4. Motor Exposure: Exterior, wet, and humid.
 5. Motor Electrical Characteristics:
 - a. Horsepower: rated (1/3) (1/2) or (3/4) hp as recommended by door manufacturer for size and type of door.
 6. Emergency Manual Operation: Chain type.
 7. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar.
 - a. Sensor Edge Bulb Color: As selected by Architect from manufacturer's full range.
 8. Control Station(s): Where shown on Drawings.
 9. Other Equipment: Audible and visual signals.
 10. Provide multiple units for remote operation.
 - J. Door Finish:
 1. Baked-Enamel or Powder-Coated Finish: Color matching Architect's sample.
 2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.4 MATERIALS, GENERAL

- 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.

2.5 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 zinc coating; nominal sheet thickness (coated) of 22 Ga; and as required.
 2. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum steel thickness of 0.010 inch.
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

2.6 HOODS

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Galvanized Steel: Nominal 22 Ga, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.

2.7 CURTAIN ACCESSORIES

- A. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

2.8 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
 1. Fire-Rated Doors: Equip with auxiliary counterbalance spring and prevent tension release from main counterbalance spring when automatic closing device operates.

- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.9 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 1. Comply with NFPA 70.
 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door Operator Location(s): Operator location indicated for each door as indicated on drawings.
- D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated.
 1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
 2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.

3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- F. Obstruction Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.
 1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
 - a. Self-Monitoring Type: Four-wire configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.
- G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
 1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
 2. Exterior-Mounted Units: Full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.
- H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- K. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.

2.10 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. 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.

2.11 STEEL AND GALVANIZED-STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
- D. Power-Operated Doors: Install automatic garage doors openers according to UL 325.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 1. Perform installation and startup checks according to manufacturer's written instructions.
 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.5 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include six months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 1. Perform maintenance, including emergency callback service, during normal working hours.
 2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

Siegel & Strain Architects

Project No. BFDW

December 8, 2023

Berkeley Fire Department Warehouse

Berkeley, CA

BID SET

END OF SECTION

SECTION 08 7100

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions of Division 1 Specification Sections, apply to this Section.

1.2 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. Thresholds, gasketing and weather-stripping.
 4. 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 – Hollow Metal Doors and Frames.
 2. Division 8: Section – Solid Core and Stile and Rail Wood Doors
 3. Division 8: Section - Aluminum Storefront
 4. Division 28: Section - Fire/Life-Safety Systems & Security Access Systems.

1.3 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
 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

1.4 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 electronic copy 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	
2	6AA	1 ea	Lockset - ND50PD x RHO x RH x 10-025 x JTMS	626	SCH	

(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) - Manufacturer 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.

1.5 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.
 - 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. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.

1.6 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.

1.7 WARRANTY

- A. Provide warranties of respective manufacturers' regular terms of sale from day of final acceptance as follows:
 - 1. Locksets: 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.

1.8 MAINTENANCE

- 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.

1.9 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

2.1 MANUFACTURERS

<u>Item</u>	<u>Manufacturer</u>	<u>Acceptable Substitutes</u>
Hinges	Ives	Hager, Stanley, McKinney
Locks, Latches & Cylinders	Schlage	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	Zero	Pemko, National Guard
Seals & Bottoms	Zero	Pemko, National Guard

2.2 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:
 - 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. 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

5. Closers shall be installed to permit doors to swing 180 degrees.
 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 manufacturer's 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.
- D. 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.
- E. Door Stops:
1. Unless otherwise noted in Hardware Sets, provide floor type with appropriate fasteners. Where floor type cannot be used, provide wall 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.
- F. 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.
- G. 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.
- H. 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 complies with NFPA 80 & NFPA 252. Where required, intumescent seals vary in requirement by door type and door manufacturer -- 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.
- I. Door Shoes & Door Top Caps: Provide door shoes at all exterior wood doors and top caps at all exterior out-swing doors.

- J. 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.

2.3 KEYING

- A. Furnish a Proprietary Schlage masterkey system as directed by the owner or architect. Key system to be designated and combinated by the Schlage Master Key Department even if pinned by the Authorized Key Center, Authorized Security Center or a local authorized commercial dealer.
- B. A detailed keying schedule is to be prepared by the owner and/or architect in consultation with a representative of Allegion or an Authorized Key Center or Authorized Security Center. Each keyed cylinder on every keyed lock is to be listed separately showing the door #, key group (in BHMA terminology), cylinder type, finish and location on the door.
- C. Extend the original Schlage masterkey system established for the project.
- D. Furnish all cylinders in the Schlage conventional style except the exit device and removable mullion cylinders which will be supplied in Schlage Full Size Interchangeable Core (FSIC). Pack change keys independently (PKI).
- E. Furnish construction keying for doors requiring locking during construction.
- F. Furnish all keys with visual key control.
1. Stamp key "Do Not Duplicate".
 2. Stamp (BHMA) key symbol on key.
- G. Furnish all cylinders with visual key control.
1. Stamp (BHMA) key symbol on side of cylinder plug (CKC).
- H. 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.
- I. 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)
- J. 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.

2.4 FINISHES

- A. Generally to be satin chrome US26D (626 on bronze and 652 on steel) unless otherwise noted.
- B. Furnish 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 dark anodized aluminum except thresholds which can be furnished as standard mill finish.

2.5 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

3.1 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.

3.2 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 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.

3.3 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: Wherever hardware installation is made more than one month prior to acceptance or occupancy, return to that work area and make final check and adjustment of all hardware items in such space or area. 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.
- 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 return to the project 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.

3.4 HARDWARE LOCATIONS

- A. Conform to CCR, Title 24, Part 2; and ADAAG; and the drawings for access-compliant positioning requirements for the disabled.

3.5 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.

3.6 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.)

GLY = Glynn-Johnson Corporation Overhead Door Stops

Siegel & Strain Architects

Project No. BFDW

December 6, 2023

Berkeley Fire Department Warehouse

Berkeley, CA

BID SET

IVE	=	Ives	Hinges, Pivots, Bolts, Coordinators, Dust Proof Strikes, Push Pull & Kick Plates, Door Stops & Silencers
LCN	=	LCN	Door Closers
SCH	=	Schlage Lock Company	Locks, Latches & Cylinders
VON	=	Von Duprin	Exit Devices
ZER	=	Zero International	Thresholds, Gasketing & Weather-stripping

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GROUP NO. 01

1	SET	CLOSER/HINGE	MAMMOTH 180	LOX
1	EA	VANDL CLASSROOM LOCK	ND94P6D RHO	SCH

GROUP NO. 02

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70P6D RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	FLOOR STOP	FS439	682	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

GROUP NO. 03

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70P6D RHO	626	SCH
1	EA	GASKETING	188SBK PSA	BK	ZER

GROUP NO. 04

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	FLOOR STOP	FS439	682	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

END OF SECTION

SECTION 08 8000

GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Glass products.
 2. Glazing sealants.
 3. Glazing tapes.
 4. Miscellaneous glazing materials.

1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. IBC: International Building Code.

1.4 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Review temporary protection requirements for glazing during and after installation.

1.6 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
1. Submit System U-Value for each condition, with each glass type
- B. Sustainable Design Submittals:
1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

2. **Product Certificates:** For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. **Product Data:** For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
4. **Building Product Disclosure Requirements:** To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs that conform to USGBC guidelines and have at least a cradle to gate scope and demonstrates product complies with required Global Warming Potential Baseline.
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
- D. Glazing Accessory Samples: For gaskets sealants and colored spacers, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- E. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- F. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For glass and glazing products, from manufacturer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for glazing sealants and glazing gaskets.
 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- C. Preconstruction adhesion and compatibility test report.
- D. Warranties: Sample of special warranties.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- B. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

- D. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
1. Install glazing in mockups specified in other Division 8 sections to match glazing systems required for Project, including glazing methods.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.11 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.12 WARRANTY

- A. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) within specified warranty period. Coverage for any other cause is excluded.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
 1. Design Wind Pressures: As indicated on Drawings.
 2. Design Snow Loads: As indicated on Drawings.
 3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 4. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
- F. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- G. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section.
 1. Provide a Product-Specific Type III Environmental Product Declaration (EPD), that meets the following parameters, and documents that each product's Global Warming Potential (GWP) is at least equal to the Carbon Leadership Forum (CLF) BETA Embodied Carbon Baselines dated 2019.11.16 as found on EC3 and as listed below for reference:
 2. Embodied Carbon (GWP) Baselines: Glass Panes
 - a. Glass: 3.5 kg CO²eq per kg/ 1.6 kg CO²eq per lb.
 3. System Boundary: Product Stage A1-A3.
 4. Declared Units: 1 kilogram or 1 pound.
 5. Product Category Rules:
 - a. NSF International PCR for GANA Flat Glass, v.1, 2014-03-31
 6. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- H. Additional Low-emitting requirements – Adhesives and Sealants:
 1. Do not use adhesives that contain urea formaldehyde.
 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- I. Sustainability Requirements:
 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.

2.2 MANUFACTURERS

- A. Basis of Design: Subject to compliance with requirements, provide glass products by Vitro Architectural Glass or a comparable product by one of the following:
 1. [Guardian Industries Corp.](#)
 2. [Pilkington North America](#).
 3. [Vetrotech Saint-Gobain](#).
 4. [Viracon, Inc.](#).
- B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.3 GLASS PRODUCTS, GENERAL

- A. Glass shall conform to ASTM C1048 and ASTM C1036, Type I, Quality-Q3, Class I – glazing select, and the following:
 1. Glass edges shall be clean scored and cut.
 2. Glass shall conform to the requirements of the Consumer Product Safety Commission's Standard 16 CFR 1201, the Safety Certification Council, ANSI Z97.1-1975, and local codes, whichever is most stringent. Notify Engineer if safety glazing is required.
- B. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
 1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
- C. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article and calculations. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- D. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 1. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
 2. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
- E. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- F. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
 1. Minimum Glass Thickness for Exterior Lites: 6 mm.
- G. Glass and glazing, in combination with adjacent construction, shall provide a fully weathertight system that promptly drains all incidental water to the exterior. Glass and glazing materials shall not block weeps or otherwise impede drainage. All glazing pockets shall drain incidental

water at the sill of each lite of glass; internal drainage of the glazing pockets at vertical mullions is not acceptable.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- C. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
 - 1. Neoprene complying with ASTM C 864.
 - 2. EPDM complying with ASTM C 864.
 - 3. Silicone complying with ASTM C 1115.
 - 4. Thermoplastic polyolefin rubber complying with ASTM C 1115.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene EPDM silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
 - 1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.
- C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.6 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; DOWSIL 795.
 - b. Pecora Corporation; 896.

- c. [Tremco Incorporated; Proglaze.](#)
- d. [Tremco Incorporated; Tremsil 600.](#)

2.7 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 - 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks:
 - 1. Silicone with Shore A durometer hardness of 85, plus or minus 5.
 - 2. Type recommended in writing by sealant or glass manufacturer.
- D. Spacers:
 - 1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
 - 2. Type recommended in writing by sealant or glass manufacturer.
- E. Edge Blocks:
 - 1. Silicone with Shore A durometer hardness per manufacturer's written instructions.
 - 2. Type recommended in writing by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 2. Presence and functioning of weep systems.
 3. Minimum required face and edge clearances.
 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- J. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 LOCK-STRIP GASKET GLAZING

- A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

3.8 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.9 MONOLITHIC GLASS SCHEDULE

- A. Glass Type: Clear float glass.
 1. Thickness: 6.0 mm.
 2. Glass shall be annealed, heat-strengthened or tempered as required by codes and as specified on drawings.
 3. Provide safety glazing labeling.

END OF SECTION

SECTION 09 2116

GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes: Gypsum board shaft wall assemblies.

1.3 ACTION SUBMITTALS

- A. Product Data: For each component of gypsum board shaft wall assembly.

- B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Product Data: For paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
4. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
5. Product Data: Laboratory test reports for ceilings, walls, acoustical and thermal insulation, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
6. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs that conform to USGBC guidelines and have at least a cradle to gate scope and demonstrates product complies with required Global Warming Potential Baseline.
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

1.4 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.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.
- C. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- D. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section.
 - 1. Embodied Carbon – Steel
 - 2. Provide a Product-Specific Type III Environmental Product Declaration (EPD), that meets the following parameters, and documents that each product's Global Warming Potential (GWP) is at least equal to the Carbon Leadership Forum (CLF) BETA Embodied Carbon Baselines dated 2019.11.16 as found on EC3 and as listed below for reference:
 - a. Embodied Carbon (GWP) Baselines: Steel
 - 1) Light-gauge metal framing – 3.0 kg CO₂eq per kg/ 1.4 kg CO₂eq per lb.
 - b. System Boundary: Product Stage A1-A3.
 - c. Declared Units: 1 kilogram or 1 pound.
 - d. Product Category Rules:
 - 1) Institut Bauen und Umwelt e.V. PCR for Thin walled profiles and profiled panels of metal, v.1.0/1.7/1.0, 2019-01-08
 - 2) International EPD System PCR for Basic iron or steel products & special steels, except construction products, v.2.0, 2020-03-27.
 - 3) UL Environment PCR for Designated Steel Construction Products, v.2.0, 2020-12-31.
 - 3. Guidance for Embodied Carbon – Gypsum Board
 - 4. Provide a Product-Specific Type III Environmental Product Declaration (EPD), that meets the following parameters, and documents that each product's Global Warming Potential (GWP) is at least equal to the Carbon Leadership Forum (CLF) BETA Embodied Carbon Baselines dated 2019.11.16 as found on EC3 and as listed below for reference:
 - a. Embodied Carbon (GWP) Baselines: Finishes

- 1) Gypsum Board – 4500 kg CO₂eq per 1000 m²/420 kgCO₂ eq 1,000 per ft²
- b. System Boundary: Product Stage A1-A3.
- c. Declared Units: 1 square meter or 1 square foot.
- d. Product Category Rules:
 - 1) NSF International PCR for PCR for Gypsum Panel Products, v.1, 2019-07-17
5. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

E. Low-emitting requirements – Interior Products

1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.

F. Additional Low-emitting requirements – Paints and Coatings:

1. Show compliance with VOC limits as detailed in Section 01 8116 “Low-Emitting Materials Restrictions”

G. Additional Low-emitting requirements – Adhesives and Sealants:

1. Do not use adhesives that contain urea formaldehyde.
2. Show compliance with VOC limits as detailed in Section 01 8116 “Low-Emitting Materials Restrictions”.

H. Additional Low-emitting requirements –Thermal and Acoustic Insulation

1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
2. Methylene chloride and perchloroethylene shall not be intentionally added in insulation products.

I. Sustainability Requirements:

1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

A. Fire-Resistance Rating: As indicated.

B. STC Rating: As indicated on Drawings.

C. Gypsum Shaftliner Board:

1. Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with paper faces.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) [CertainTeed Corporation](#).
 - 2) [Georgia-Pacific Building Products](#).
 - 3) [National Gypsum Company](#).
 - 4) [United States Gypsum Company](#).
2. Moisture- and Mold-Resistant Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with moisture- and mold-resistant core and surfaces.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) [CertainTeed Corporation](#).

- 2) [Georgia-Pacific Building Products](#).
3) [National Gypsum Company](#).
4) [United States Gypsum Company](#).
3. Moisture- and Mold-Resistant, Fiberglass-Mat Faced: ASTM C 1658/C 1658M; manufacturer's proprietary fire-resistive liner panels with ASTM D 3273 mold-resistance score of 10 as rated according to ASTM D 3274, 1 inch thick, and with double beveled long edges.
- a. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
- 1) [American Gypsum](#).
2) [Georgia-Pacific Building Products](#).
3) [United States Gypsum Company](#).
- D. Non-Load-Bearing Steel Framing, General: Complying with ASTM C 645 requirements for metal unless otherwise indicated and complying with requirements for fire-resistance-rated assembly indicated.
1. Protective Coating: Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 unless otherwise indicated.
- E. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.
1. Depth: As indicated.
2. Minimum Base-Metal Thickness 0.033 inch.
- F. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.
1. Minimum Base-Metal Thickness: Matching steel studs.
- G. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
- a. [Blazeframe Industries](#).
b. [CEMCO; California Expanded Metal Products Co.](#).
c. [Fire Trak Corp.](#).
d. [GCP Applied Technologies Inc. \(formerly Grace Construction Products\)](#).
- H. Elevator Hoistway Entrances: Manufacturer's standard J-profile jamb strut with long-leg length of 3 inches, matching studs in depth, and not less than 0.033 inch thick.
- I. Room-Side Finish: Gypsum board.
- J. Shaft-Side Finish: As indicated by fire-resistance-rated assembly design designation.
- K. Insulation: Sound attenuation blankets.
- 2.3 AUXILIARY MATERIALS**
- A. General: Provide auxiliary materials that comply with manufacturer's written recommendations.
- B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 09 2900 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.

- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
- D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
 - 1. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing according to ASTM E 488 conducted by a qualified testing agency.
 - 2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing according to ASTM E 1190 conducted by a qualified testing agency.
- E. Reinforcing: Galvanized-steel reinforcing strips with 0.033-inch minimum thickness of base metal (uncoated).
- F. Acoustical Sealant: As specified in Section 09 2900 "Gypsum Board."
- G. Gypsum Board Cants:
 - 1. Gypsum Board Panels: As specified in Section 09 2900 "Gypsum Board," Type X, 1/2- or 5/8-inch panels.
 - 2. Adhesive: Laminating adhesive as specified in Section 09 2900 "Gypsum Board."
 - 3. Non-Load-Bearing Steel Framing: As specified in Section 09 2216 "Non-Structural Metal Framing."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to which gypsum board shaft wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway door frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Sprayed Fire-Resistive Materials: Coordinate with gypsum board shaft wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft wall assemblies to comply with requirements specified in Section 07 8100 "Applied Fireproofing."
- B. After sprayed fire-resistive materials are applied, remove only to extent necessary for installation of gypsum board shaft wall assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION

- A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and ASTM C 754 other than stud-spacing requirements.
- B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.
- C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.
 - 1. Elevator Hoistway: At elevator hoistway-entrance door frames, provide jamb struts on each side of door frame.
 - 2. Reinforcing: Where handrails directly attach to gypsum board shaft wall assemblies, provide galvanized steel reinforcing strip with 0.033-inch minimum thickness of base metal (uncoated), accurately positioned and secured behind at least one layer of face panel.
- D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.
- E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.
- F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- G. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.
- H. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.
- I. Gypsum Board Cants: At projections into shaft exceeding 4 inches, install 1/2- or 5/8-inch-thick gypsum board cants covering tops of projections.
 - 1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft wall framing.
 - 2. Where steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to shaft wall framing.
- J. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.4 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 09 2216

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior ceilings and soffits.
3. Grid suspension systems for gypsum board ceilings.

- B. Related Requirements:

1. Section 05 4000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs that conform to USGBC guidelines and have at least a cradle to gate scope and demonstrates product complies with required Global Warming Potential Baseline.
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of code-compliance certification for studs and tracks.
- B. Evaluation Reports: For embossed steel studs and tracks firestop tracks post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

- A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft.
- D. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- E. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 - 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.
- F. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section when available.
 - 1. Provide a Product-Specific Type III Environmental Product Declaration (EPD), that meets the following parameters, and documents that each product's Global Warming Potential (GWP) is at least equal to the Carbon Leadership Forum (CLF) BETA Embodied Carbon Baselines dated 2019.11.16 as found on EC3 and as listed below for reference:
 - 2. Embodied Carbon (GWP) Baselines: Steel
 - a. Light-gauge metal framing – 3.0 kg CO₂eq per kg/ 1.4 kg CO₂eq per lb.
 - 3. System Boundary: Product Stage A1-A3.
 - 4. Declared Units: 1 kilogram or 1 pound.
 - 5. Product Category Rules:
 - a. Institut Bauen und Umwelt e.V. PCR for Thin walled profiles and profiled panels of metal, v.1.0/1.7/1.0, 2019-01-08
 - b. International EPD System PCR for Basic iron or steel products & special steels, except construction products, v.2.0, 2020-03-27.
 - c. UL Environment PCR for Designated Steel Construction Products, v.2.0, 2020-12-31.
 - 6. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

2.2 FRAMING SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. [CEMCO; California Expanded Metal Products Co.](#)
 2. [ClarkDietrich Building Systems](#)
 3. [MarinoWARE.](#)
 4. [MBA Building Supplies](#)
 5. [SCAFCO Steel Stud Company.](#)
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.
- D. Studs and Runners: ASTM C 645. Use either steel studs and runners or embossed steel studs and runners.
 1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 0.0329 inch.
 - b. Depth: As indicated on Drawings.
 2. Embossed Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally equivalent to conventional ASTM C 645 steel studs and tracks.
 - a. Minimum Base-Metal Thickness: 0.0190 inch.
 - b. Depth: As indicated on Drawings.
- E. Slip-Type Head Joints: Where indicated, provide the following:
 1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 2-inch minimum vertical movement.
 2. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 3. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 4. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- F. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- G. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 1. Minimum Base-Metal Thickness: 0.033 inch.
- H. Cold-Rolled Channel Bridging: Steel, 0.053-inchminimum base-metal thickness, with minimum 1/2-inch-wide flanges.
 1. Depth: As indicated on Drawings.

2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- I. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 1. Minimum Base-Metal Thickness: 0.0329 inch.
 2. Depth: As indicated on Drawings.
- J. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.
 1. Configuration: Asymmetrical or hat shaped.
- K. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
 1. Depth: As indicated on Drawings.
 2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- L. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- B. Hanger Attachments to Concrete:
 1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 AC193 AC58 or AC308 as appropriate for the substrate.
 - a. Uses: Securing hangers to structure.
 - b. Type: Torque-controlled, expansion anchor torque-controlled, adhesive anchor or adhesive anchor.
 - c. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 - d. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
 2. Power-Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- D. Flat Hangers: Steel sheet, in size indicated on Drawings.
- E. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges.
 1. Depth: As indicated on Drawings.
- F. Furring Channels (Furring Members):
 1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
 2. Steel Studs and Tracks: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.0329 inch.
 - b. Depth: As indicated on Drawings.

3. Embossed Steel Studs and Tracks: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.0190 inch.
 - b. Depth: As indicated on Drawings.
 4. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base-Metal Thickness: 0.0329 inch.
 5. Resilient Furring Channels: 1/2-inch-deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical or hat shaped.
- G. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. [Armstrong World Industries, Inc.](#)
 - b. [Chicago Metallic Corporation](#).
 - c. [United States Gypsum Company](#).

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.
- C. Sound Isolation Clips:
 1. Sound isolation clips specified shall be designed and manufactured by Kinetics Noise Control, Dublin, Ohio. Product shall be Model Iso-Max Sound Isolation Clips.
 2. Vertical Load capacity. Clips shall have sufficient capacity to support wall or ceiling weights as constructed. In a vertical load test comparable to a ceiling installation, the clip shall have a minimum design load capacity of 36 lbs. using 25 gauge furring channel. The minimum design load capacity when using 22 gauge furring channel shall be 48 lbs. Design Load capacity shall be based on a safety factor where the load to failure, defined as pullout of the channel from the clip, is a minimum 2.5 times the allowable maximum Design Load. Anchors for attachment of the clips to the substructure shall be selected to support wall and/or ceiling weights at each clip.
 3. The isolation clips shall consist of a rubber element into which a standard galvanized steel furring channel, 7/8 in. x minimum 25 gauge, is captured. The channel legs snap fit into the rubber element without any metal-to-metal or other rigid contact with building elements.
 4. The isolation clip is attached to the wall/ceiling framing or other structural substrate through galvanized steel brackets on each side of the rubber isolation element. The brackets shall be of sufficient strength to carry the wall or ceiling weight without bending or failure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
 4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
 - 2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
 - 3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 - 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.
- E. Direct Furring:
 - 1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Z-Shaped Furring Members:
 - 1. Erect insulation, specified in Section 07 2100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches o.c.
 - 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 - 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring

channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING CEILING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Hangers: 48 inches o.c.
 2. Carrying Channels (Main Runners): 48 inches o.c.
 3. Furring Channels (Furring Members): 24 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 5. Do not attach hangers to steel roof deck.
 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- F. Isolation clips: Spacing and location of sound isolation clips shall be determined by the manufacturer based on wall or ceiling type. Installation drawing details shall be provided by the manufacturer to assure optimum sound control and structural integrity of the system.
- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

Siegel & Strain Architects

Project No. BFDW

December 8, 2023

Berkeley Fire Department Warehouse

Berkeley, CA

BID SET

END OF SECTION

FSECTION 09 2900

GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

B. Related Requirements:

1. Section 06 1600 "Sheathing" for gypsum sheathing for exterior walls.
2. Section 09 2116 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
3. Section 09 2216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
4. Section 09 3000 "Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Product Data: For paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
4. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
5. Product Data: Laboratory test reports for ceilings, walls, acoustical and thermal insulation, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
6. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs that conform to USGBC guidelines and have at least a cradle to gate scope and demonstrates product complies with required Global Warming Potential Baseline.

- b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

C. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

1.4 QUALITY ASSURANCE

- A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations.
 2. Apply or install final decoration indicated, including painting, on exposed surfaces for review of mockups.
 3. Simulate finished lighting conditions for review of mockups.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 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.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, 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, those that are moisture damaged, and those that are 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

- B. Sound-Rated Assemblies: For Sound-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.

- C. Environmental Certification: Provide materials carrying certification by one of the following:
1. Greenguard Gold Certification

- D. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- E. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section.
1. Provide a Product-Specific Type III Environmental Product Declaration (EPD), that meets the following parameters, and documents that each product's Global Warming Potential (GWP) is at least equal to the Carbon Leadership Forum (CLF) BETA Embodied Carbon Baselines dated 2019.11.16 as found on EC3 and as listed below for reference:
 2. Embodied Carbon (GWP) Baselines: Finishes
 - a. Gypsum Board – 4500 kg CO₂eq per 1000 m²/420 kgCO₂ eq 1,000 per ft²
 3. System Boundary: Product Stage A1-A3.
 4. Declared Units: 1 square meter or 1 square foot.
 5. Product Category Rules:
 - a. ASTM International PCR for North American Glass Mat Gypsum Panels, v.1, 2016-08-01.
 - b. NSF International PCR for PCR for Gypsum Panel Products, v.1, 2019-07-17
 6. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- F. Low-emitting requirements – Interior Products
1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- G. Additional Low-emitting requirements – Paints and Coatings:
1. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions"
- H. Additional Low-emitting requirements – Adhesives and Sealants:
1. Do not use adhesives that contain urea formaldehyde.
 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- I. Sustainability Requirements:
1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.

2.2 GYPSUM BOARD, GENERAL

- A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Wallboard: ASTM C 1396/C 1396M.

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. [CertainTeed Corp](#) Air Renew Gypsum Board and Gypsum Board
 - b. [National Gypsum Company](#) Gold Bond Gypsum Board
 - c. [USG Corporation](#) Sheetrock and FiberRock
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 1. Thickness: 5/8 inch.
 2. Long Edges: Tapered.
 3. Products:
 - a. United States Gypsum Company, LLC, "USG Sheetrock® Brand EcoSmart Panels Firecode® X".
 - b. Certainteed Type X Gypsum Board.
- C. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
 1. Thickness: 1/2 inch.
 2. Long Edges: Tapered.
- D. Impact-Resistant Gypsum Board: ASTM C 1396/C 1396M gypsum board, tested according to ASTM C 1629/C 1629M.
 1. Core: 5/8 inch, Type X.
 2. Surface Abrasion: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements.
 3. Indentation: ASTM C 1629/C 1629M, meets or exceeds Level 1 requirements.
 4. Soft-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements.
 5. Hard-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements according to test in Annex A1.
 6. Long Edges: Tapered.
 7. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- E. Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
 1. Core: 5/8 inch, Type X.
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. [CertainTeed Corp](#); FiberCement Underlayment or BackerBoard.
 - b. [National Gypsum Company](#), [Permabase Cement Board](#).
 - c. [USG Corporation](#); [DUROCK Cement Board](#).
 2. Thickness: 5/8 inch.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc or Paper-faced galvanized steel sheet.
 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.

- d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.
 - g. Curved-Edge Cornerbead: With notched or flexible flanges.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. [Fry Reglet Corp.](#)
 - b. [Gordon, Inc.](#)
 - c. [Pittcon Industries.](#)
 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 1. Interior Gypsum Board: Paper.
 2. 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.
 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 drying-type, all-purpose 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 or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
- D. Joint Compound for Tile Backing Panels:
 1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- 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.
 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through

perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

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. Acoustical Sealant for Concealed Joints:
 - a. Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.
 - b. Pecora Corporation; AIS-919.
 - c. Tremco, Inc.; Tremco Acoustical Sealant.

E. Thermal and Acoustic Insulation: As specified in Section 07 2100 "Thermal Insulation."

F. Moldable putty for application to electrical boxes and other penetrations of acoustical barriers.

1. Pre-formed 1/8-inch pads
2. Non-toxic, asbestos-free
3. Acceptable Product and Manufacturer:
 - a. Quiet Putty QP-380 by Quiet Solution; 1250 Elko Dr.; Sunnyvale, CA 94089; 800/797-8159
 - b. Outlet Box Pads by Harry A. Lowry & Associates, 11176 Penrose St., Sun Valley, CA 91352, 818/768-4661

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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 in ceiling 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, except floors. 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. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Sound-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 recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
1. Wallboard Type X: Vertical surfaces unless otherwise indicated.
 2. Ceiling Type: Ceiling surfaces.
 3. Impact-Resistant Type: As indicated on Drawings.
 4. Mold-Resistant Type: As indicated on Drawings.
- B. 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.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
 2. 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.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
 4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.
- 3.4 INSTALLATION OF TILE BACKING PANELS**
- A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
 - B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.
- 3.5 INSTALLATION OF 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.
 - B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
 - C. Interior Trim: Install in the following locations:
 1. Cornerbead: Use at outside corners unless otherwise indicated.
 2. Bullnose Bead: Use where indicated.
 3. LC-Bead: Use at exposed panel edges.
 4. L-Bead: Use where indicated.
 5. U-Bead: Use where indicated.
 6. Curved-Edge Cornerbead: Use at curved openings.
 - D. Aluminum Trim: Install in locations indicated on Drawings.

3.6 FINISHING GYPSUM BOARD

- 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 C 840:
 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 2. Level 2: Panels that are substrate for tile.

1. Level 3: Where indicated on Drawings.
 2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 09 9123 "Interior Painting."
 3. For Level 4 gypsum board finish, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.
 4. For Level 1 gypsum board finish, embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 FIELD QUALITY CONTROL

- A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
 1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.

3.8 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.

END OF SECTION

SECTION 09 5113

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for interior ceilings.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 3. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 4. Product Data: For interior components indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 5. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs that conform to USGBC guidelines and have at least a cradle to gate scope and demonstrates product complies with required Global Warming Potential Baseline.
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Samples: For each exposed product and for each color and texture specified, 6 inches in size.
- D. Samples for Initial Selection: For components with factory-applied finishes.

- E. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
1. Acoustical Panels: Set of 6-inch-square Samples of each type, color, pattern, and texture.
 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch-long Samples of each type, finish, and color.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Ceiling suspension-system members.
 2. Structural members to which suspension systems will be attached.
 3. Method of attaching hangers to building structure.
 - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
 4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
 5. Size and location of initial access modules for acoustical panels.
 6. Items penetrating finished ceiling and ceiling-mounted items including the following:
 - a. Lighting fixtures.
 - b. Diffusers.
 - c. Grilles.
 - d. Speakers.
 - e. Sprinklers.
 - f. Access panels.
 - g. Perimeter moldings.
 7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
 8. Minimum Drawing Scale: 1/4 inch = 1 foot.
- B. Qualification Data: For testing agency.
- C. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.
- E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.8 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.
 - 1. Build mockup of typical ceiling area.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Class A according to ASTM E 1264.
 - 2. Smoke-Developed Index: 50 or less.
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL or from the listings of another qualified testing agency.
- C. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- D. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section where available.

1. Provide a Product-Specific Type III Environmental Product Declaration (EPD), that meets the following parameters, and documents that each product's Global Warming Potential (GWP) is at least equal to the Carbon Leadership Forum (CLF) BETA Embodied Carbon Baselines dated 2019.11.16 as found on EC3 and as listed below for reference:
2. Embodied Carbon (GWP) Baselines: Finishes
 - a. Ceiling Panels – 30 kg CO₂eq per m²/ 2.8 kgCO₂ eq per ft²
3. System Boundary: Product Stage A1-A3.
4. Declared Units: 1 square meter or 1 square foot.
5. Product Category Rules: Non-metal ceilings
 - a. Guidance for Building Related Products and Services, From the range of Environmental Product Declarations of UL Environment: "Part B: Non-Metal Ceiling Panel EPD Requirements", October 2015v1. North American LCA Environmental Impact Results
 - b. UL Environment PCR for Part B: Non-Metal Ceiling Panels, v.1, 2015-10-16
 - c. PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 3.2. UL Environment. September 2018 PCR Guidance for Building-Related Products and Services Part B: Flooring EPD Requirements. Version 2. UL Environment. September 2018.
 - d. Institut Bauen und Umwelt e.V. PCR for Mineral panels, v.1.0/1.6/1.1, 2018-12-10
6. Product Category Rules: Metal ceilings
 - a. Institut Bauen und Umwelt e.V. PCR for Metal Ceilings, v.1.0/1.7/1.0, 2019-01-08
7. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

E. Low-emitting requirements – Interior Products

1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.

F. Additional Low-emitting requirements – Adhesives and Sealants:

1. Do not use adhesives that contain urea formaldehyde.
2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".

G. Additional Low-emitting requirements –Thermal and Acoustic Insulation

1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
2. Methylene chloride and perchloroethylene shall not be intentionally added in insulation products.

H. Sustainability Requirements:

1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.

2.3 ACOUSTICAL PANELS, GENERAL

- A. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.
- B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

- C. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.
- D. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.
- E. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

2.4 ACOUSTICAL PANELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. [Armstrong World Industries, Inc.](#)
 - 2. [CertainTeed Corp.](#)
 - 3. [USG Interiors, Inc.; Subsidiary of USG Corporation.](#)
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.5 METAL SUSPENSION SYSTEM

- A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.
 - 1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C 635/C 635M.
- B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 9/16-inch-wide metal caps on flanges.
 - 1. Structural Classification: Intermediate-duty system.
 - 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 - 3. Face Design: Flat, flush.
 - 4. Cap Material: Cold-rolled steel or aluminum.
 - 5. Cap Finish: Painted in color as selected from manufacturer's full range.

2.6 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated.
 - 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488/E 488M or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

- a. Type: Postinstalled bonded anchors.
 - b. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
- 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch-diameter wire.
- C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- D. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.

2.7 METAL EDGE MOLDINGS AND TRIM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. [Armstrong World Industries, Inc.](#)
 - 2. [CertainTeed Corp.](#)
 - 3. [Fry Reglet Corporation.](#)
 - 4. [Gordon, Inc.](#)
 - 5. [USG Interiors, Inc.; Subsidiary of USG Corporation.](#)
- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
- 1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
 - 2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
- C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with design requirements.
- 1. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
 - 2. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.8 ACOUSTICAL SEALANT

- A. Products: Subject to compliance with requirements, provide one of 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. [Acoustical Sealant for Concealed Joints:](#)
 - a. [Henkel Corporation](#); OSI Pro-Series SC-175 Acoustical Sound Sealant.
 - b. [Hilti](#) CP605
 - c. [Pecora Corporation](#); AIS-919.

- d. [Tremco, Inc.](#); Tremco Acoustical Sealant.
- B. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
 2. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant.

PART 3 - EXECUTION

3.1 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 anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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 unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.
 1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
- B. Suspend ceiling hangers from building's structural members and as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and

- appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 8. Do not attach hangers to steel deck tabs.
 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
 5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 6. Protect lighting fixtures and air ducts according to requirements indicated for fire-resistance-rated assembly.

3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 6513

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Resilient base.
2. Resilient molding accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
4. Product Data: For interior components indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
5. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations:
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

- C. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

- D. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 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. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 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.
 - 1. Coordinate mockups in this Section with mockups specified in other Sections.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- B. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section.
 - 1. Environmental Product Declarations:
 - 2. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Low-emitting requirements – Interior Products
 - 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- D. Additional Low-emitting requirements – Adhesives and Sealants
 - 1. Do not use adhesives that contain urea formaldehyde.

2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- E. Additional Low-emitting requirements – Flooring:
1. **FloorScore Compliance:** Hard Surface flooring and Adhesives shall comply with requirements of FloorScore Standard.
- F. Sustainability Requirements:
1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.

2.2 MANUFACTURERS

- A. Basis of Design: Subject to compliance with requirements, provide Tarkett Johnsonite or a comparable product by one of the following:
1. Nora systems Inc.
 2. Roppe Corporation USA
 3. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.

2.3 RESILIENT BASE

- A. Resilient Base Standard: ASTM F 1861 Type TS (rubber, vulcanized thermoset) or ASTM F 1861 Type TP (rubber, thermoplastic).
1. Manufacturing Method: Group I (solid, homogeneous) or Group II (layered).
 2. Style and Location:
 - a. Style A, Straight: In areas with carpet.
 - b. Style B, Cove: In areas with resilient flooring.
- B. Thickness: 0.125 inch.
- C. Height: 4 inches.
- D. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
- E. Outside Corners: Job formed.
- F. Inside Corners: Job formed.
- G. Colors: As indicated by manufacturer's designations.

2.4 MOLDING ACCESSORY

- A. Description:
1. Cap for cove carpet.
 2. Cap for cove resilient flooring.
 3. Carpet bar for tackless installations.
 4. Carpet edge for glue-down applications.
 5. Nosing for carpet.
 6. Nosing for resilient flooring.
 7. Reducer strip for resilient flooring.
 8. Joiner for tile and carpet.

9. Transition strips.
- B. Profile and Dimensions: As indicated.
- C. Locations: Provide rubber molding accessories in areas indicated.
- D. Colors and Patterns: As indicated by manufacturer's designations.

2.5 INSTALLATION MATERIALS

- A. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.
- B. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- C. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
 1. All adhesives will be required to carry Cradle to Cradle Silver certification score or higher, including the following:
 - a. truRenew Carpet Flooring Adhesive SP by WF Taylor
 - b. Shaw 5100 Adhesive
 - c. XL Brands flooring adhesives
- D. Metal Edge Strips: Extruded aluminum with mill finish, nominal 2 inches wide, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until materials are the same temperature as space where they are to be installed.
 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Job-Formed Corners:
 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 1. Remove adhesive and other blemishes from surfaces.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

SECTION 09 9123

INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.
- B. Related Requirements:
1. Section 05 1200 "Structural Steel Framing" and Section 05 1213 "Architecturally Exposed Structural Steel Framing" for shop priming structural steel.
 2. Section 05 5000 "Metal Fabrications" for shop priming metal fabrications.
 3. Section 05 5113 "Metal Stairs" for shop priming metal pan stairs.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
- B. Sustainable Design Submittals:
1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.

2. **Product Data:** For paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 3. **Building Product Disclosure Requirements:** To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations;
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Samples for Initial Selection: For each type of topcoat product.
- D. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 1. Submit Samples on rigid backing, 8 inches square.
 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.
- E. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 1. [Benjamin Moore & Co.](#)
 2. [Dunn-Edwards Corporation](#)
 3. [Ecos Paints](#)
 4. [Kelly-Moore Paint Company Inc.](#)
 5. [PPG Architectural Coatings](#)
 6. [Sherwin-Williams Company \(The\)](#)

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- D. **Building Product Disclosure Requirements:** Provide Building Product Disclosure documentation for products used in this section.
 1. Environmental Product Declarations:
 2. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- E. **Additional Low-emitting requirements – Paints and Coatings:**
 1. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions"
- F. **Sustainability Requirements:**
 1. Provide products manufactured and extracted within 100 miles of the project site whenever possible.
- G. Colors: Match Architect's samples.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 1. Concrete: 12 percent.
 2. Masonry (Clay and CMU): 12 percent.
 3. Wood: 15 percent.
 4. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.

- e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 1. low odor/VOC Latex System MPI INT 3.1M:
 - a. Prime Coat: Primer sealer, interior, MPI #50, 50 X-Green, 149, 149 X-Green.
 - 1) Benjamin Moore® Natura® Zero-VOC Primer 511.
 - 2) Benjamin Moore® Eco Spec® WB Interior Latex Primer N372.
 - 3) Benjamin Moore® Ultra Spec® 500 Interior Primer N534.
 - 4) PPG Paints; Speedhide zero Interior Latex Sealer, 6-4900XI Series.
 - 5) Sherwin Williams Harmony Interior Latex Primer
 - 6) Sherwin Williams ProMar 200 Zero Interior Latex Primer
 - 7) Sherwin Williams Quick Dry Stain Blocking Primer

- b. Intermediate Coat: Interior, matching topcoat.
- c. Topcoat: Flat (MPI Gloss Level 1) MPI # 53, X-Green 53, 143, X-Green 143
 - 1) Benjamin Moore® Natura® Interior Waterborne Flat Finish 512.
 - 2) Benjamin Moore® Eco Spec® WB Interior Latex Flat Finish N373.
 - 3) Benjamin Moore® Ultra Spec® 500 Interior Flat Finish N536.
 - 4) PPG Paints; Speedhide zero Interior Latex Flat, 6-4110XI Series.
 - 5) Sherwin Williams Harmony Interior Acrylic Latex Flat
 - 6) Sherwin Williams ProMar 200 Interior Acrylic Latex Flat
 - 7) Sherwin Williams Solo Interior/Exterior 100% Acrylic Latex
 - 8) Sherwin Williams Cashmere Interior Acrylic Flat Enamel
 - 9) Sherwin Williams Duration Home Interior Flat
- d. Topcoat: Low sheen (MPI Gloss Level 2) MPI# 44/X-Green 44, 144/X-Green 144
 - 1) Benjamin Moore® Natura® Interior Waterborne Eggshell Finish 513.
 - 2) Benjamin Moore Ultra Spec 500 Interior Low Sheen N537.
 - 3) PPG Paints; Speedhide zero Interior Latex Eggshell, 6-4310XI Series.
 - 4) Sherwin Williams Harmony Interior Acrylic Latex Eg-Shel
 - 5) Sherwin Williams ProMar 200 Interior Acrylic Latex Eg-Shel
 - 6) Sherwin Williams Eco-Select Zero VOC Eg-Shel
- e. Topcoat: Eggshell (MPI Gloss Level 3) MPI # 52, X-Green 52, 145, X-Green 145, 139, X-Green 139:
 - 1) Benjamin Moore® Eco Spec® WB Interior Latex Eggshell Finish N374.
 - 2) Benjamin Moore Ultra Spec 500 Latex Eggshell N538.
 - 3) PPG Paints; Speedhide zero Interior Latex Satin, 6-4410XI Series.
 - 4) Sherwin Williams ProMar 200 Interior Acrylic Latex Eg-Shel
 - 5) Sherwin Williams Cashmere Interior Acrylic Medium Lustre
- f. Topcoat: Latex, interior (MPI Gloss Level 4), MPI #43 43 X-Green:
 - 1) Benjamin Moore® Ultra Spec® 500 Interior Semi-Gloss N539.
 - 2) Benjamin Moore® Super Hide® Zero VOC Interior Semi-Gloss 358.
 - 3) Sherwin Williams EcoSelect Zero VOC Semi-Gloss
 - 4) Sherwin Williams ProMar 200 Zero VOC Interior Latex Semi-Gloss
 - 5) Sherwin Williams ProMar 400 Zero VOC Interior Latex Semi-Gloss
- g. Topcoat: Semi-gloss (MPI Gloss Level 5), MPI # 54, X-Green 54, 147, X-Green 147, 141, X-Green 141.
 - 1) Benjamin Moore® Eco Spec® WB Interior Latex Semi-Gloss Finish N376.
 - 2) Benjamin Moore Ultra Spec 500 Interior Latex Gloss N540.
 - 3) PPG Paints; Speedhide zero Interior Latex Semi-Gloss, 6-4510XI Series.
 - 4) Sherwin Williams Harmony Interior Latex Semi-Gloss
 - 5) Sherwin Williams ProMar 200 Interior Latex Gloss
 - 6) Sherwin Williams ProMar 400 Interior Latex Gloss
 - 7) Sherwin Williams Cashmere Interior Acrylic Medium Lustre

B. Concrete Substrates, Traffic Surfaces:

- 1. Water-Based Concrete Floor Sealer System MPI INT 3.2G:
 - a. First Coat: Sealer, water based, for concrete floors, matching topcoat.
 - b. Topcoat: Sealer, water based, for concrete floors, MPI #99.
 - 1) PPG Paints; Perma-Crete Plex-Seal WB Interior/Exterior 100% Acrylic Clear Sealer, 4-6200XI Series.
- 2. Acrylic-Based Concrete Floor Sealer System
 - a. Basis of Design: ECOS Concrete Sealer
 - b. First Coat: Sealer, acrylic based, for concrete floors, matching topcoat.
 - c. Topcoat: Sealer, acrylic based, for concrete floors.

C. CMU Substrates:

- 1. Latex System MPI INT 4.2A:
 - a. Block Filler: Block filler, latex, interior/exterior, MPI #4, X-Green 4:

- 1) Benjamin Moore® Ultra Spec® Hi-Build Masonry Block Filler 571.
- 2) PPG Paints: Speedhide Interior/Exterior Masonry Hi Fill Latex Block Filler, 6-15XI.
- b. Intermediate Coat: matching topcoat.
- c. Topcoat: Flat (MPI Gloss Level 1) MPI # 53, X-Green 53, 143, X-Green 143:
 - 1) Benjamin Moore® Natura® Interior Waterborne Flat Finish 512.
 - 2) Benjamin Moore® Eco Spec® WB Silver Interior Latex Flat Finish 473.
 - 3) Benjamin Moore® Eco Spec® WB Interior Latex Flat Finish N373.
 - 4) Benjamin Moore® Ultra Spec® 500 Interior Flat Finish N536.
 - 5) PPG Paints; Speedhide zero Interior Latex Flat, 6-4110XI Series.
 - 6) Sherwin Williams Harmony Interior Acrylic Latex Flat
 - 7) Sherwin Williams ProMar 200 Interior Acrylic Latex Flat
 - 8) Sherwin Williams Solo Interior/Exterior 100% Acrylic Latex
 - 9) Sherwin Williams Cashmere Interior Acrylic Flat Enamel
 - 10) Sherwin Williams Duration Home Interior Flat
- d. Topcoat: Low sheen (MPI Gloss Level 2) MPI# 44/X-Green 44, 144/X-Green 144
 - 1) Benjamin Moore® Natura® Interior Waterborne Eggshell Finish 513
 - 2) Benjamin Moore Ultra Spec 500 Interior Low Sheen N537.
 - 3) PPG Paints; Speedhide zero Interior Latex Eggshell, 6-4310XI Series.
 - 4) Sherwin Williams Harmony Interior Acrylic Latex Eg-Shel
 - 5) Sherwin Williams ProMar 200 Interior Acrylic Latex Eg-Shel
 - 6) Sherwin Williams Eco-Select Zero VOC Eg-Shel
- e. Topcoat: Eggshell (MPI Gloss Level 3), MPI #52, 52 X-Green, 139, 139 X-Green, 145, 145 X-Green,
 - 1) Benjamin Moore® Eco Spec® WB Interior Latex Eggshell Finish N374.
 - 2) Benjamin Moore Ultra Spec 500 Latex Eggshell N538.
 - 3) PPG Paints; Speedhide zero Interior Latex Satin, 6-4410XI Series.
 - 4) Sherwin Williams ProMar 200 Interior Acrylic Latex Eg-Shel
 - 5) Sherwin Williams Cashmere Interior Acrylic Medium Lustre
- f. Topcoat: Latex, interior (MPI Gloss Level 4), MPI #43 43 X-Green:
 - 1) Benjamin Moore® Ultra Spec® 500 Interior Semi-Gloss N539.
 - 2) Benjamin Moore® Super Hide® Zero VOC Interior Semi-Gloss 358.
 - 3) Sherwin Williams EcoSelect Zero VOC Semi-Gloss
 - 4) Sherwin Williams ProMar 200 Zero VOC Interior Latex Semi-Gloss
 - 5) Sherwin Williams ProMar 400 Zero VOC Interior Latex Semi-Gloss
- g. Topcoat: Semi-gloss (MPI Gloss Level 5), MPI # 54, X-Green 54, 141, X-Green 141.
 - 1) Benjamin Moore® Eco Spec® WB Interior Latex Semi-Gloss Finish N376.
 - 2) Benjamin Moore Ultra Spec 500 Interior Latex Gloss N540.
 - 3) PPG Paints; Speedhide zero Interior Latex Semi-Gloss, 6-4510XI Series.
 - 4) Sherwin Williams Harmony Interior Latex Semi-Gloss
 - 5) Sherwin Williams ProMar 200 Interior Latex Gloss
 - 6) Sherwin Williams ProMar 400 Interior Latex Gloss
 - 7) Sherwin Williams Cashmere Interior Acrylic Medium Lustre

D. Steel Substrates:

1. Institutional Low-Odor/VOC Latex System MPI INT 5.1S:
 - a. Prime Coat: Primer, rust inhibitive, water based MPI #79
 - 1) Benjamin Moore® Ultra Spec® HP Acrylic Metal Primer HP04.
 - 2) Pitt-Tech Interior/Exterior Industrial DTM Primer, 90-712 Series.
 - b. Intermediate Coat: Latex, interior, low odor/VOC, matching topcoat.
 - c. Topcoat: Flat (MPI Gloss Level 1) MPI # 53, X-Green 53, 143, X-Green 143
 - 1) Benjamin Moore® Natura® Interior Waterborne Flat Finish 512.
 - 2) Benjamin Moore® Eco Spec® WB Silver Interior Latex Flat Finish 473.
 - 3) Benjamin Moore® Eco Spec® WB Interior Latex Flat Finish N373.

- 4) Benjamin Moore® Ultra Spec® 500 Interior Flat Finish N536.
 - 5) PPG Paints; Speedhide zero Interior Latex Flat, 6-4110XI Series.
 - 6) Sherwin Williams Harmony Interior Acrylic Latex Flat
 - 7) Sherwin Williams ProMar 200 Interior Acrylic Latex Flat
 - 8) Sherwin Williams Solo Interior/Exterior 100% Acrylic Latex
 - 9) Sherwin Williams Cashmere Interior Acrylic Flat Enamel
 - 10) Sherwin Williams Duration Home Interior Flat
- d. Topcoat: Low sheen (MPI Gloss Level 2) MPI# 44/X-Green 44, 144/X-Green 144
- 1) Benjamin Moore® Natura® Interior Waterborne Eggshell Finish 513.
 - 2) Benjamin Moore Ultra Spec 500 Interior Low Sheen N537.
 - 3) PPG Paints; Speedhide zero Interior Latex Eggshell, 6-4310XI Series.
 - 4) Sherwin Williams Harmony Interior Acrylic Latex Eg-Shel
 - 5) Sherwin Williams ProMar 200 Interior Acrylic Latex Eg-Shel
 - 6) Sherwin Williams Eco-Select Zero VOC Eg-Shel
- e. Topcoat: Eggshell (MPI Gloss Level 3) MPI # 52, X-Green 52, 145, X-Green 145, 139, X-Green 139:
- 1) Benjamin Moore® Eco Spec® WB Interior Latex Eggshell Finish N374.
 - 2) Benjamin Moore Ultra Spec 500 Latex Eggshell N538.
 - 3) PPG Paints; Speedhide zero Interior Latex Satin, 6-4410XI Series.
 - 4) Sherwin Williams ProMar 200 Interior Acrylic Latex Eg-Shel
 - 5) Sherwin Williams Cashmere Interior Acrylic Medium Lustre
- f. Topcoat: Latex, interior (MPI Gloss Level 4), MPI #43 43 X-Green:
- 1) Benjamin Moore® Ultra Spec® 500 Interior Semi-Gloss N539.
 - 2) Benjamin Moore® Super Hide® Zero VOC Interior Semi-Gloss 358.
 - 3) Sherwin Williams EcoSelect Zero VOC Semi-Gloss
 - 4) Sherwin Williams ProMar 200 Zero VOC Interior Latex Semi-Gloss
 - 5) Sherwin Williams ProMar 400 Zero VOC Interior Latex Semi-Gloss
- g. Topcoat: Semi-gloss (MPI Gloss Level 5), MPI # 54, X-Green 54, 147, X-Green 147, 141, X-Green 141.
- 1) Benjamin Moore® Eco Spec® WB Interior Latex Semi-Gloss Finish N376.
 - 2) Benjamin Moore Ultra Spec 500 Interior Latex Gloss N540.
 - 3) PPG Paints; Speedhide zero Interior Latex Semi-Gloss, 6-4510XI Series.
 - 4) Sherwin Williams Harmony Interior Latex Semi-Gloss
 - 5) Sherwin Williams ProMar 200 Interior Latex Gloss
 - 6) Sherwin Williams ProMar 400 Interior Latex Gloss
 - 7) Sherwin Williams Cashmere Interior Acrylic Medium Lustre

E. Metal decking, bar joists, exposed ductwork

1. Water-Based Dry-Fall System MPI INT 5.1CC:
 - a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.
 - 1) Benjamin Moore® Super Spec HP® Alkyd Metal Primer P06.
 - 2) PPG Paints; Speedhide Rust Inhibitive Primer, 6-208/212 Series.
 - b. Prime Coat: Shop primer specified in Section where substrate is specified.
 - c. Topcoat: flat, MPI #118.
 - 1) Benjamin Moore® Latex Dry Fall Flat 395 (46 g/L).
 - 2) PPG Paints; Speedhide Super Tech WB Interior Latex Dry Fog, Flat 6-725XI Series.
 - d. Topcoat: Dry fall, latex (MPI Gloss Level 3), MPI #155.
 - 1) Benjamin Moore® Latex Dry Fall Eggshell 396.
 - 2) PPG Paints; Speedhide Super Tech WB Interior 100% Acrylic Latex Dry Fog, Eggshell 6-724XI Series.
 - e. Topcoat: Dry fall, latex (MPI Gloss Level 5), MPI #226.
 - 1) Benjamin Moore® Latex Dry Fall Semi-Gloss 397.
 - 2) PPG Paints; Speedhide Super Tech WB Interior 100% Acrylic Latex Dry Fog, Semi-Gloss 6-727XI Series.

F. Wood Substrates: Wood trim and Architectural woodwork.

1. Institutional Low-Odor/VOC Latex System MPI INT 6.3V:
 - a. Prime Coat: Primer, latex, for interior wood, MPI #6, 39, 137.
 - 1) Benjamin Moore® Sure Seal™ Latex Primer Sealer 027.
 - 2) PPG Paints; Gripper Interior/Exterior 100% Acrylic Primer/Sealer, 3210XI.
 - b. Topcoat: Flat (MPI Gloss Level 1) MPI # 53, X-Green 53, 143, X-Green 143
 - 1) Benjamin Moore® Natura® Interior Waterborne Flat Finish 512.
 - 2) Benjamin Moore® Eco Spec® WB Silver Interior Latex Flat Finish 473.
 - 3) Benjamin Moore® Eco Spec® WB Interior Latex Flat Finish N373.
 - 4) Benjamin Moore® Ultra Spec® 500 Interior Flat Finish N536.
 - 5) PPG Paints; Speedhide zero Interior Latex Flat, 6-4110XI Series.
 - 6) Sherwin Williams Harmony Interior Acrylic Latex Flat
 - 7) Sherwin Williams ProMar 200 Interior Acrylic Latex Flat
 - 8) Sherwin Williams Solo Interior/Exterior 100% Acrylic Latex
 - 9) Sherwin Williams Cashmere Interior Acrylic Flat Enamel
 - 10) Sherwin Williams Duration Home Interior Flat
 - c. Topcoat: Low sheen (MPI Gloss Level 2) MPI# 44/X-Green 44, 144/X-Green 144
 - 1) Benjamin Moore® Natura® Interior Waterborne Eggshell Finish 513
 - 2) Benjamin Moore Ultra Spec 500 Interior Low Sheen N537.
 - 3) PPG Paints; Speedhide zero Interior Latex Eggshell, 6-4310XI Series.
 - 4) Sherwin Williams Harmony Interior Acrylic Latex Eg-Shel
 - 5) Sherwin Williams ProMar 200 Interior Acrylic Latex Eg-Shel
 - 6) Sherwin Williams Eco-Select Zero VOC Eg-Shel
 - d. Topcoat: Eggshell (MPI Gloss Level 3) MPI # 52, X-Green 52, 145, X-Green 145, 139, X-Green 139:
 - 1) Benjamin Moore® Eco Spec® WB Interior Latex Eggshell Finish N374.
 - 2) Benjamin Moore Ultra Spec 500 Latex Eggshell N538.
 - 3) PPG Paints; Speedhide zero Interior Latex Satin, 6-4410XI Series.
 - 4) Sherwin Williams ProMar 200 Interior Acrylic Latex Eg-Shel
 - 5) Sherwin Williams Cashmere Interior Acrylic Medium Lustre
 - e. Topcoat: Semi-Gloss (MPI Gloss Level 4), MPI #43, #43 X-Green, 140, 140 X-Green, 146, 146 X-Green .
 - 1) Benjamin Moore® Ultra Spec® 500 Interior Semi-Gloss N539.
 - 2) Benjamin Moore® Super Hide® Zero VOC Interior Semi-Gloss 358.
 - 3) Sherwin Williams EcoSelect Zero VOC Semi-Gloss
 - 4) Sherwin Williams ProMar 200 Zero VOC Interior Latex Semi-Gloss
 - 5) Sherwin Williams ProMar 400 Zero VOC Interior Latex Semi-Gloss
 - f. Topcoat: Semi-gloss (MPI Gloss Level 5), MPI # 54, X-Green 54, 147, X-Green 147, 141, X-Green 141.
 - 1) Benjamin Moore® Eco Spec® WB Interior Latex Semi-Gloss Finish N376.
 - 2) Benjamin Moore Ultra Spec 500 Interior Latex Gloss N540.
 - 3) PPG Paints; Speedhide zero Interior Latex Semi-Gloss, 6-4510XI Series.
 - 4) Sherwin Williams Harmony Interior Latex Semi-Gloss
 - 5) Sherwin Williams ProMar 200 Interior Latex Gloss
 - 6) Sherwin Williams ProMar 400 Interior Latex Gloss
 - 7) Sherwin Williams Cashmere Interior Acrylic Medium Lustre

G. Gypsum Board and Plaster Substrates:

1. Institutional Low-Odor/VOC Latex System MPI INT 9.2M:
 - a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #50, 50 X-Green, 149, 149 X-Green.
 - 1) Benjamin Moore® Natura® Waterborne interior Primer 511.
 - 2) Benjamin Moore® Eco Spec® WB Interior Latex Primer N372.
 - 3) Benjamin Moore® Ultra Spec® 500 Interior Primer N534.
 - 4) PPG Paints; Speedhide zero Interior Latex Sealer, 6-4900XI Series.

- 5) Sherwin Williams Harmony Interior Latex Primer
- 6) Sherwin Williams ProMar 200 Zero Interior Latex Primer
- 7) Sherwin Williams Quick Dry Stain Blocking Primer
- b. Intermediate Coat: matching topcoat.
- c. Topcoat: Flat (MPI Gloss Level 1) MPI # 53, X-Green 53, 143, X-Green 143
 - 1) Benjamin Moore® Natura® Interior Waterborne Flat Finish 512.
 - 2) Benjamin Moore® Eco Spec® WB Silver Interior Latex Flat Finish 473.
 - 3) Benjamin Moore® Eco Spec® WB Interior Latex Flat Finish N373.
 - 4) Benjamin Moore® Ultra Spec® 500 Interior Flat Finish N536.
 - 5) PPG Paints; Speedhide zero Interior Latex Flat, 6-4110XI Series.
 - 6) Sherwin Williams Harmony Interior Acrylic Latex Flat
 - 7) Sherwin Williams ProMar 200 Interior Acrylic Latex Flat
 - 8) Sherwin Williams Solo Interior/Exterior 100% Acrylic Latex
 - 9) Sherwin Williams Cashmere Interior Acrylic Flat Enamel
 - 10) Sherwin Williams Duration Home Interior Flat
- d. Topcoat: Low sheen (MPI Gloss Level 2) MPI# 44/X-Green 44, 144/X-Green 144
 - 1) Benjamin Moore® Natura® Interior Waterborne Eggshell Finish 513.
 - 2) Benjamin Moore Ultra Spec 500 Interior Low Sheen N537.
 - 3) PPG Paints; Speedhide zero Interior Latex Eggshell, 6-4310XI Series.
 - 4) Sherwin Williams Harmony Interior Acrylic Latex Eg-Shel
 - 5) Sherwin Williams ProMar 200 Interior Acrylic Latex Eg-Shel
 - 6) Sherwin Williams Eco-Select Zero VOC Eg-Shel
- e. Topcoat: Eggshell (MPI Gloss Level 3) MPI # 52, X-Green 52, 145, X-Green 145, 139, X-Green 139:
 - 1) Benjamin Moore® Eco Spec® WB Interior Latex Eggshell Finish N374.
 - 2) Benjamin Moore Ultra Spec 500 Latex Eggshell N538.
 - 3) PPG Paints; Speedhide zero Interior Latex Satin, 6-4410XI Series.
 - 4) Sherwin Williams ProMar 200 Interior Acrylic Latex Eg-Shel
 - 5) Sherwin Williams Cashmere Interior Acrylic Medium Lustre
- f. Topcoat: Semi-Gloss (MPI Gloss Level 4), MPI #43, 43 X-Green, 140, 140 X-Green, 146, 146 X-Green.
 - 1) Benjamin Moore® Ultra Spec® 500 Interior Semi-Gloss N539.
 - 2) Benjamin Moore® Super Hide® Zero VOC Interior Semi-Gloss 358.
 - 3) Sherwin Williams EcoSelect Zero VOC Semi-Gloss
 - 4) Sherwin Williams ProMar 200 Zero VOC Interior Latex Semi-Gloss
 - 5) Sherwin Williams ProMar 400 Zero VOC Interior Latex Semi-Gloss
- g. Topcoat: Semi-gloss (MPI Gloss Level 5), MPI # 54, X-Green 54, 147, X-Green 147, 141, X-Green 141.
 - 1) Benjamin Moore® Eco Spec® WB Interior Latex Semi-Gloss Finish N376.
 - 2) Benjamin Moore Ultra Spec 500 Interior Latex Gloss N540.
 - 3) PPG Paints; Speedhide zero Interior Latex Semi-Gloss, 6-4510XI Series.
 - 4) Sherwin Williams Harmony Interior Latex Semi-Gloss
 - 5) Sherwin Williams ProMar 200 Interior Latex Gloss
 - 6) Sherwin Williams ProMar 400 Interior Latex Gloss
 - 7) Sherwin Williams Cashmere Interior Acrylic Medium Lustre

END OF SECTION

SECTION 10 1100

VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Visual display board assemblies:
 - a. Markerboards.
 - b. Tackboards.
2. Visual display rails.
3. Magnetic Visual Display Wall Covering

1.3 DEFINITIONS

- A. Tackboard: Framed or unframed, tackable, visual display board assembly.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for visual display surfaces.

- B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
4. Chain-of-Custody Qualification Data: For manufacturer and vendor.
5. Product Data: Laboratory test reports for products containing composite wood or agrifiber products or wood glues, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
6. Product Data: For paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
7. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
8. Product Data: For interior components indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
9. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations:

- b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show locations of panel joints.
 - 2. Show locations of special-purpose graphics for visual display surfaces.
 - 3. Include sections of typical trim members.
- D. Samples for Initial Selection: For each type of visual display unit indicated, for units with factory-applied color finishes, and as follows:
 - 1. Samples of facings for each visual display panel type, indicating color and texture.
 - 2. Actual factory-finish color samples, applied to substrate.
 - 3. Include accessory Samples to verify color selected.
- E. Samples for Verification: For each type of visual display surface indicated.
 - 1. Visual Display Surface: Not less than 8-1/2 by 11 inches, mounted on substrate indicated for final Work. Include one panel for each type, color, and texture required.
 - 2. Trim: 6-inch-long sections of each trim profile.
 - 3. Display Rail: 6-inch-long sections.
- F. Product Schedule: For visual display surfaces. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of fabrics.
- C. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of motor-operated, sliding visual display units required for this Project.
- B. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body and is a certified participant in AWI's Quality Certification Program.
- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-built visual display surfaces, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefabricate components at the factory, disassemble for delivery, and make final joints at the site.
- B. Store visual display surfaces vertically with packing materials between each unit.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings 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.

1.9 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Surfaces lose original writing and erasing qualities.
 - b. Surfaces exhibit crazing, cracking, or flaking.
 2. Warranty Period: Life of the building.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of visual display unit from single source from single manufacturer.
- B. Manufacturers: Subject to compliance with requirements and unless otherwise noted, provide products by one of the following:
1. Marker Board:
 - a. [PolyVision Corporation; a Steelcase company.](#)
 - b. [Best-Rite Manufacturing](#): MooreCo. Inc.
 - c. Bi Silque SA
 - d. [Claridge Products and Equipment, Inc.](#)
 - e. [Clarus inc](#)

2.2 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
 2. Smoke-Developed Index: 450 or less.
- B. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- C. [Building Product Disclosure Requirements](#): Provide Building Product Disclosure documentation for products used in this section.
1. Environmental Product Declarations:
 2. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- D. [Low-emitting requirements – Interior Products](#)

1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
 - E. Additional Low-emitting requirements – Paints and Coatings:
 1. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions"
 - F. Additional Low-emitting requirements – Adhesives and Sealants:
 1. Do not use adhesives that contain urea formaldehyde.
 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - G. Low-emitting requirements – Composite Wood:
 1. Composite Wood Evaluation - Composite wood, as defined by the California Air Resources Board, Airborne Toxic Measure to Reduce Formaldehyde Emissions from Composite Wood Products Regulation, shall be documented to have low formaldehyde emissions which meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
 - H. Certified Wood: Wood shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
 - I. Sustainability Requirements:
 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.
- 2.3 VISUAL DISPLAY BOARD ASSEMBLY
- A. Visual Display Board Assembly: factory fabricated.
 1. Assembly: markerboard and tackboard.
 2. Corners: Square.
 3. Width: As indicated on Drawings.
 4. Height: As indicated on Drawings.
 5. Mounting Method: Direct to wall.
 - B. Markerboard Panel: Porcelain-enamel-faced markerboard panel on core indicated.
 1. Color: As selected by Architect from full range of industry colors.
 - C. Tackboard Panel: Linoleum tackboard panel on core indicated.
 1. Color and Pattern: As selected by Architect from full range of industry colors.
 - D. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch-thick, extruded aluminum; slim size and standard shape.
 1. Aluminum Finish: Clear anodic finish.
 - E. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect as indicated on approved Shop Drawings.
 - F. Markertray: Manufacturer's standard; continuous.
 1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

- G. Map Rail: Provide the following accessories:
1. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 1 to 2 inches wide.
 2. End Stops: Located at each end of map rail.
 3. Poster Clips: Four map hooks with flexible metal clips for every 6 feet of map rail or fraction thereof.

2.4 DISPLAY RAILS

- A. Aluminum Display Rail: Continuous and integral with map rail; fabricated from cork approximately 1 to 2 inches wide..
1. Tackable Insert Color: As selected by Architect from full range of industry colors.
 2. End Stops: Located at each end of map rail.
 3. Poster Clips: Four map hooks with flexible metal clips for every 6 feet of map rail or fraction thereof.

2.5 MARKERBOARD PANELS

- A. Porcelain-Enamel Markerboard Panels: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction, consisting of moisture-barrier backing, core material, and porcelain-enamel face sheet with low-gloss finish. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive.
1. Face Sheet Thickness: 0.021 inch uncoated base metal thickness.
 2. Manufacturer's Standard Core: Minimum 1/4 inch thick, with manufacturer's standard moisture-barrier backing.
 3. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.

2.6 TACKBOARD PANELS

- A. Basis of Design Product: Forbo Bulletin Board
1. Equal Products by other manufacturers approved in accordance with Division 1 Section *Product Substitution Procedures*.
- B. Linoleum Resilient tackable surface material on a burlap backing. Color to extend throughout the thickness of material.

2.7 MATERIALS, GENERAL

- A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.
- B. Hardboard: ANSI A135.4, tempered.
- C. Particleboard: ANSI A208.1, Grade M-1.
- D. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
- E. Fiberboard: ASTM C 208 cellulosic fiber insulating board.
- F. Clear Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality Q3, with exposed edges seamed before tempering.
- G. Extruded Aluminum: ASTM B 221, Alloy 6063.

- H. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

2.8 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. 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.

2.9 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motor-operated, sliding visual display units.
- C. Examine walls and partitions for proper preparation and backing for visual display surfaces.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.
 1. Prime wall surfaces indicated to receive visual display wall coverings and as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
 2. Prepare substrates indicated to receive visual display wall covering as required by manufacturer's written instructions to achieve a smooth, dry, clean, structurally sound surface that is uniform in color.
 - a. Moisture Content: Maximum of 4 percent when tested with an electronic moisture meter.

- b. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity. Prime with primer as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
- c. Metals: If not factory primed, clean and apply metal as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
- d. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
- e. Painted Surfaces: Treat areas susceptible to pigment bleeding.

3.3 INSTALLATION, GENERAL

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
 - 1. Mounting Height: 36 inches above finished floor to top of chalktray.

3.4 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY BOARDS AND ASSEMBLIES

- A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to walls.

3.5 INSTALLATION OF VISUAL DISPLAY RAILS

- A. Display Rails: Install rails in locations and at mounting heights indicated on Drawings, or if not indicated, at height indicated below. Attach to wall surface with fasteners at not more than 16 inches o.c.

3.6 CLEANING AND PROTECTION

- A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies exterior and interior identification, informational and directional signs as indicated in the project sign type drawings. Provide all documentation, engineering, materials and labor as necessary for the fabrication and installation of the specified sign program.

1.2 APPLICABLE STANDARDS AND PUBLICATIONS - Unless otherwise noted, utilize the most recent publications of the referenced standards and publications.

- A. Uniform Building Code
- B. ATBCB Design Guidelines for Signage in relation to the Americans With Disabilities Act
- C. California Building Codes
- D. Uniform Sign Code

1.3 CONTRACTOR QUALIFICATIONS

- A. It is required that the sign contractor currently and regularly manufactures and installs sign programs similar in nature and scale to that specified in this project with a minimum of three years of experience. At most one-third of the contract value may be subcontracted to outside vendors.

1.4 QUALITY ASSURANCE

- A. The sign contractor is responsible for the quality of all materials and workmanship required for the execution of the work specified in this section, whether executed by their own firm or firms subcontracting or supplying on their behalf. Sign contractor is responsible for providing their subcontractors with all pertinent project documents, information, and coordination.

1.5 SUBMITTAL REQUIREMENTS

- A. Shop Drawings - Provide shop drawings indicating the manufacture and installation details of all sign types including but not limited to sign structures, footings, mounting, attachments, typography, layouts, lighting, colors and finishes. Provide stamped structural engineered drawings and calculations, by a suitably licensed engineer, for all sign elements.
- B. Color & Finish Samples – Provide 4 qty. - 8" x 10" samples of each color
- C. Sample Signs – Produce 1 qty. (sign type tbd) sign for review.

- D. Manufacturer's Data - Provide manufacturer's specifications, data, installation details, maintenance instructions and other information for complete products specified within this section.

1.6 PERMITS

- A. It is required that the selected sign fabricator obtain all necessary permits for the fabrication and installation of this sign program from the suitable jurisdiction.

PART 2 - PRODUCTS

- 2.1 GENERAL - Provide graphics elements as completed units produced to the greatest extent possible by a single manufacturer, including necessary and incidental mounting accessories, fittings and connectors.

- A. Contractor Responsibility - The sign contractor, by commencing work on this section, assumes overall responsibility in assuring that materials, components, assemblies, and installations as shown or required as a part of the work within this section or other related sections complies with the requirements of the contract documents and as a part of the warranty of the work. The contractor shall further warrant, that all components specified or incidentally required are compatible with each other and adjoining installation conditions, that there are no conditions which will cause materials or assemblies to perform to their full life expectancy, that materials are compatible to adjoining substrates, finishes, materials and work by other trades, and that the individual parts and overall systems are effectively integrated and correct.
- B. Interpretations of Contract Drawings - Do not scale drawings for dimensions. Use only written dimensions provided on drawings, unless there are discrepancies found. The contractor is responsible for verifying all dimensions and conditions shown on drawings. The Designer is to be notified of any discrepancy in drawings or conditions requiring changes or preventing proper installation of the graphics elements.
- C. Site Conditions – There are variances in the wall conditions for areas specified for wall-applied graphics that may require adjustments in the scale and positioning of graphics from the Construction Intent drawings. The contractor is to thoroughly survey and identify these discrepancies prior to submitting shop drawings and suggest adjustments to allow for these condition variances as part of their shop drawing submittal, and at no additional cost to the owner.

2.2 GRAPHIC STANDARDS

- A. Typography
1. Refer to Graphics Standards Sheet in Sign Type Drawings.
 2. Fonts – Per Graphic Standards sheet.
 3. Letterspacing – Utilize letterspacing as indicated in sign type drawings. Provide full size samples of layouts for sign types specified in submittal section of this specification.
- B. Colors - Refer to Graphics Standards Sheet in Sign Type Drawings.
- C. Finishes
1. Standard Paint Finishes – Satin (Satin MAP)
- D. Evacuation Map Artwork

1. Designer to provide example digital template for the contractor to develop with the suitable plan area, positioning and information for each location. Submit artwork for approval prior to fabricating.
- 2.3 SIGN TYPES – Refer to sign type drawings for additional specifications and information on individual sign types.
- 2.4 MATERIALS
- A. Aluminum
1. Sheet and Plate - Utilize domestically sourced 6061 alloy, ASTM B221 unless otherwise notified, or other alloy is required to fulfill performance requirements. Utilize sizes, alloys, tempers and gauges as necessary to fulfill performance requirements, and to provide proper characteristics for fabrication, assembly and finishing as called for in the contract documents.
 2. Extrusions and Tubing - Utilize domestically sourced 6061 alloy, ASTM B221 unless otherwise notified, or other alloy is required to fulfill performance requirements. Utilize sizes, alloys, tempers and gauges as necessary to fulfill performance requirements, and to provide proper characteristics for fabrication, assembly and finishing as called for in the contract documents. Minimum wall thickness is .125 inch unless otherwise specified.
 3. Where attaching aluminum components to steel, provide coating or other barrier between metals to prevent galvanic oxidization.
- B. Steel
1. Structural Tubing - Utilize domestically sourced sizes, alloys, tempers and gauges as necessary to fulfill performance requirements and to provide proper characteristics for fabrication, assembly and finishing as called for in the contract documents.
 2. Sheet and Plate - Utilize domestically sourced sizes, alloys, tempers and gauges as necessary to fulfill performance requirements, and to provide proper characteristics for fabrication, assembly and finishing as called for in the contract documents.
 3. Structural Assemblies - Fabricate and assemble in shop to the greatest extent possible, following AISC specifications.
 4. Connections - Weld or bolt shop connections as called for in project documents or shop drawings. Bolt field connections unless welded connections are specifically called for in design or engineering specifications.
 5. Welded Construction - Comply with AWS code for procedures, appearance, quality of welds and methods used in correcting welded work. Utilize only certified welders.
 6. Galvanized Steel – Hot dipped galvanized after components have been cut to size.
- C. Acrylic
1. Clear, Non-glare Acrylic - Acrylite Satin Clear or similar.
- D. Paint
1. Acrylic Polyurethane (Low VOC) - Multi-component catalytic opaque coating material consisting of pigmented base and activator. Follow manufacturer's specifications for ingredient ratios, surface preparation, priming, application methods, drying and handling of finishes.
 2. Paint finish shall be smooth and consistent, free of surface imperfections, orange peel texture, scratches, gouges, drips, bubbles, uneven coating application, overspray or other surface imperfections.
 3. Utilize Matthews Satin MAP or approved equal.

4. Surface coatings are to be compatible with adhesives and other materials utilized to apply graphics or other elements to their surface, with no discoloration or other deterioration.
- E. Fasteners
1. Unless otherwise specified, utilize stainless steel fasteners for mechanical connections. Upon installation, paint finish any exposed fasteners to match the surrounding finish.
- F. Foam Tape
1. Double-sided acrylic adhesive closed cell urethane foam tape, 3M Series A20, #4016 or equal. Preparation of sign and mounting surface and installation techniques to be per manufacturer's specifications.
- G. Silicone Sealant
1. Clear silicone-based commercial-grade adhesive as manufactured by General Electric. Preparation of sign and mounting surface and installation techniques to be per manufacturer's specifications.
- H. Vinyl Graphics
1. Utilize 3M vinyl products, suitable for installation surfaces.
- I. Tactile Signs
1. Utilize exterior grade photopolymer or other approved equal for tactile and Braille sign types.

PART 3 - EXECUTION

3.1 FABRICATION

- A. Design, fabricate and install components to allow for expansion and contraction within a minimum of a 100-degree F temperature range, without causing excessive opening, buckling or overstressing of joints, adhesives, welds and fasteners.
- B. Form work to specified sizes, shapes and profiles, with true curves, lines and angles. Provide necessary brackets, lugs and mounting points as required for assembly. Use concealed fasteners wherever possible.
- C. Shop fabricate as much as is practical, minimizing field fabrication. Fasten joints flush to conceal attachments, or weld, grind smooth and finish joints where possible.
- D. Shop and field assembled joints are to be true and tight, with minimal use of filling compounds. Finish hollow sign elements with matching material on all faces, tops, bottoms and ends, so that elements appear solid.
- E. Signs shall have a consistent, smooth surface, with even texture, straight edges and flat panel surfaces. Panel surfaces are to be flat and true with a maximum surface tolerance is 1/8 inch for 10 feet in length. Lines, joints and miters are to be smooth and sharp, with profiles accurate and ornament true to pattern.
- F. Extruded members are to be free of extrusion marks.

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- G. Pre-drill holes for bolts and screws. Exposed ends and edges of panels are to be milled smooth with slightly eased edges.
- H. All painted surfaces are to have proper surface preparation and priming prior to application of finish coatings. Finish is to be even with no light application allowing substrate or primer to show.
- I. All moveable parts, including hardware are to be assembled and finished to allow for smooth operation without binding, deformation or distortion of adjoining members. All contact surfaces are to fit tight without forcing or warping components.

3.2 INSTALLATION

- A. Protect products against damage during field handling and installation. Protect adjacent existing materials, finishes and landscaping as necessary to prevent damage. Touch up exposed hardware to match color and finish of surrounding surface after installation.
- B. Coordinate timing of installation work with general contractor and project management to insure execution of work does not interfere with the smooth, normal operation of this facility.
- C. Mount signs in proper alignment, level and plumb in accordance with the contract documents. Where not otherwise specified, signs shall be installed where best suited to provide a consistent appearance throughout the project. For L-configured signs, shim back panels to insure tight, straight corner fit.
- D. Contractor shall own and be responsible for all signs that are damaged, lost or stolen while materials are on the job site, and until the final acceptance of the job by the owner.
- E. Correct or remove signs or installation work deemed by the owner as unsafe immediately upon notification.
- F. Upon completing installation, clean all sign surfaces and adjacent building surfaces affected by sign installation prior to calling for inspection. Replace any damaged landscaping materials to match condition prior to installation.

END OF SECTION

Sign Schedule is in the drawing set.

SECTION 10 4413

FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.
 2. Automated External Defibrillator Cabinets
- B. Related Requirements:
1. Section 10 4416 "Fire Extinguishers."

1.3 PREINSTALLATION CONFERENCE

- A. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to fire-protection cabinets including, but not limited to, the following:
 - a. Schedules and coordination requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
- B. Sustainable Design Submittals:
1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 3. Product Data: Laboratory test reports for interior products indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 4. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations:
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

- D. Samples: For each type of exposed finish required.
 - E. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.
- 1.5 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.
- 1.6 COORDINATION
- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
 - B. Coordinate sizes and locations of fire-protection cabinets and AED cabinets with wall depths.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
- A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.
- 2.2 PERFORMANCE REQUIREMENTS
- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.
 - B. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
 - C. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section.
 1. Environmental Product Declarations:
 2. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
 - D. Low-emitting requirements – Interior Products
 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
 - E. Sustainability Requirements:
 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.

2.3 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Basis of Design Product – Recessed cabinet: Subject to compliance with requirements, provide Larsen's model #0-2409 or comparable product by one of the following:
 - a. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - b. Potter Roemer LLC.
 - 2. Basis of Design Product – Semi-Recessed and surface mounted cabinet: Subject to compliance with requirements, provide Larsen's model #2409 – Architectural Series or comparable product by one of the following:
 - a. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - b. Potter Roemer LLC.
- B. Cabinet Construction: UL listed with fire resistance rating of hall where it is installed.
 - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-thick cold-rolled steel sheet lined with minimum 5/8-inch-thick fire-barrier material. Provide factory-drilled mounting holes.
- C. Cabinet Material: Cold-rolled steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- D. Recessed Cabinet:
 - 1. Trimless with Concealed Flange: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box to act as drywall bead.
- E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
 - 1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.
- F. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.
- G. Cabinet Trim Material: Same material and finish as door.
- H. Door Material: Steel sheet.
- I. Door Style:
 - 1. Recessed Cabinet: Vertical duo panel with frame.
 - 2. Semi-Recessed Cabinet: Solid opaque panel with frame.
 - 3. Surface Mounted Cabinet: Solid opaque panel with frame.
- J. Door Glazing: Acrylic sheet.
 - 1. Acrylic Sheet Color: Clear transparent acrylic sheet.
- K. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide manufacturer's standard.
 - 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- L. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

2. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
3. Door Lock: Cylinder lock, keyed alike to other cabinets.
4. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Pressure-sensitive vinyl letters.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.
5. Alarm: Manufacturer's standard alarm that actuates when fire-protection cabinet door is opened and that is powered by batteries.
6. Manufactures projecting wall mounted sign, indicating 'FIRE EXTINGUISHER'.
 - 1) Application Process: Pressure-sensitive vinyl letters.
 - 2) Lettering Color: Red.
 - 3) Orientation: Vertical.
- b. Provide Manufacturer's Standard factory installed identification for AED Cabinets

M. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
 - b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - c. Color: As selected by Architect from manufacturer's full range.
2. Transparent Acrylic Sheet: ASTM D4802, Category A-1 (cell-cast sheet), with Finish 1 (smooth or polished).

2.4 AUTOMATED DEFIBRILLATOR CABINET

- A. Cabinet, Non-Rated: Cabinet box constructed of cold-rolled steel with baked enamel finish and tempered float glass door viewing window.
1. Basis of Design: Heartstation 5300- Semi Recessed Defibrillator Cabinet. RC5300RB or a comparable product by one of the following:
 - a. Larsen's Manufacturing Company.
 - b. Potter Roemer LLC
 - c. J.L. Industries, Inc., a division of Activar Construction Products Group
 2. Cabinet Rough-in Size: Not to exceed 14"H x 14"W x 7"D, as required to incorporate AED and specified features. All cabinet components and equipment shall be accessible, removable and replaceable with the cabinet door in a 90 degree position.
 - a. Provide compact cabinets where indicated
 3. Cabinet Door and Trim Material: Manufacturer's standard steel sheet
 4. Door Style: Tempered Float Glass with frame of material and finish to match box and trim
- B. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type and door material and style indicated, and as follows:
1. Provide Recessed handle as required with mounting type to maintain ADA minimum projection clearances

2.5 AUTOMATED EXTERNAL DEFIBRILLATORS

- A. AED manufactured by Philips, model #861304 HeartStart FRx Defibrillator with the following options and accessories; model #OptR01 HeartStart FRX ready- Pack, model #989803139311 Infant/ Child Key, model #68-PCHAT Fast Response Kit.

2.6 FABRICATION

- A. Fire Protection and AED Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 1. Weld joints and grind smooth.
 2. Miter corners and grind smooth.
 3. Provide factory-drilled mounting holes.
 4. Prepare doors and frames to receive locks.
 5. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. 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

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for recessed and semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection and AED Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification: Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 10 4416

FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Owner-Furnished Material: Hand-carried fire extinguishers.
- C. Related Requirements:
 - 1. Section 10 4413 "Fire Protection Cabinets."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. [Amerex Corporation](#).
 - b. [JL Industries, Inc.; a division of the Activar Construction Products Group](#).
 - c. [Kidde Residential and Commercial Division](#); Subsidiary of Kidde plc.
 - d. [Larsens Manufacturing Company](#).
 - e. [Potter Roemer LLC](#).
 - 2. Valves: Manufacturer's standard.
 - 3. Handles and Levers: Manufacturer's standard.
 - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. [Amerex Corporation](#).
 - b. [JL Industries, Inc.; a division of the Activar Construction Products Group](#).
 - c. [Larsens Manufacturing Company](#).
 - d. [Potter Roemer LLC](#).
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Horizontal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION

SECTION 12 3600

COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Solid-surface-material countertops and backsplashes.

- B. Related Requirements:

1. Section 22 4000 "Plumbing Fixtures" for non-integral sinks and plumbing fittings.

1.3 ACTION SUBMITTALS

- A. Product Data: For countertop materials and sinks.

- B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
4. Chain-of-Custody Qualification Data: For manufacturer and vendor.
5. Product Data: Laboratory test reports for products containing composite wood or agrifiber products or wood glues, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
6. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
7. Product Data: For interior components indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
8. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations:
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

- C. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

- D. Samples for Initial Selection: For each type of material exposed to view.

- E. Samples for Verification: For the following products:
1. Countertop material, 6 inches square.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of countertops.
- C. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body and is a certified participant in AWI's Quality Certification Program.
- D. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.
1. Build mockup of typical countertop as shown on Drawings.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.
- B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
- C. Keep finished surfaces of countertops covered with protective covering during handling and installation.

1.9 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- B. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section.
 - 1. Environmental Product Declarations:
 - 2. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Low-emitting requirements – Interior Products
 - 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- D. Additional Low-emitting requirements – Adhesives and Sealants:
 - 1. Do not use adhesives that contain urea formaldehyde.
 - 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- E. Low-emitting requirements – Composite Wood:
 - 1. Composite Wood Evaluation - Composite wood, as defined by the California Air Resources Board, Airborne Toxic Measure to Reduce Formaldehyde Emissions from Composite Wood Products Regulation, shall be documented to have low formaldehyde emissions which meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
- F. Certified Wood: Wood shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
- G. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 - 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.

2.2 SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
 - 1. Basis of Design: Subject to compliance with requirements, provide products listed on Finish Legend, or comparable products and price groups by one of the following:
 - a. Corian by E.I. du Pont de Nemours and Company
 - b. Avonite Surfaces
 - 2. Integral Sink Bowls: Comply with CSA B45.5/IAPMO Z124.
 - 3. Colors and Patterns: As selected by Architect from manufacturer's full range.
 - 4. Countertops: 3/4-inch-thick, solid surface material.
 - 5. Window Stools: ½ inch thick, solid surface material.

6. Composition: 100 percent recycled glass aggregate combined with Portland cement and color pigments formed into flat slabs. Petroleum based resins not permitted
- B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.
 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.
 1. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
 2. Medium Density Fiberboard (MDF): ANSI 208.2
 - a. Basis of Design: "Medite II," 3/4 inch thick, by SierraPine Composite Solutions, Roseville, CA.
 3. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded
 4. Hardwood Veneer Plywood: HPVA HP-1, Non-toxic, urea formaldehyde free: with soy-based adhesive:
 - a. Basis of Design: Purebond by Columbia Forest Products Inc.
 5. Fire Rated Plywood FR plywood at secure walls: Either DOC PS 1 or DOC PS 2, Exposure 1 sheathing.
 6. Nominal Thickness: Not less than 1 1/8 inches and as indicated.

2.4 COUNTERTOP FABRICATION

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
 1. Grade: Custom.
- B. Configuration:
 1. Front: Straight, chamfered at top.
 2. Backsplash: Straight, slightly eased at corner.
 3. End Splash: Matching backsplash.
- C. Countertops: 3/4-inch-thick, material with front edge built up with same material.
- D. Backsplashes: 3/4-inch-thick, material.
- E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 1. Fabricate with loose backsplashes for field assembly.
 2. Install integral sink bowls in solid surface countertops in the shop.
- F. Joints: Fabricate countertops in sections for joining in field.
 1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
 2. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.

- G. Cutouts and Holes:
1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
 2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
 3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.5 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 07 9200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
 1. Install metal splines in kerfs in countertop edges at joints where indicated. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
 2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

- F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- G. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.
- H. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
 - 1. Seal edges of cutouts in particleboard subtops by saturating with varnish.
- I. Apply sealant to gaps at walls; comply with Section 07 9200 "Joint Sealants."

END OF SECTION

SECTION 21 0000
FIRE SUPPRESSION BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 Design-Build Summary of Work

- A. Work included in 21 00 00 applies to Division 21, Fire Suppression work to provide materials, labor, tools, permits and incidentals to make fire suppression systems ready for Owner's use for proposed project.

1.2 Design-Build Instructions

- A. This document is issued to give Bidders a basis for preparing a proposal to design and install a complete Fire Suppression system for this project.
- B. Alternates to this Document may be offered as a separate proposal.

1.3 Design-Build Design Approach

- A. Use this Specification as a guide for design/engineering requirements, workmanship and materials or construction. Utilize design-build concept throughout construction phase of project.
- B. Investigate and be apprised of applicable codes, rules, and regulations as enforced by AHJ.
- C. Visit the Site of the proposed construction. Verify and inspect the existing site to determine conditions that affect this work.

1.4 Design-Build Criteria/Calculations

A. Related Work Specified Elsewhere:

- 1. Contents of Section apply to Division 21, Fire Suppression Specifications.
 - 2. Requirements of Section are a minimum for Division 21, Fire Suppression Sections, unless otherwise stated in each Section, in which case that Section's requirements take precedence.
- B. Fire Suppression Design Criteria: Refer to individual Division 21, Fire Suppression Sections for fire suppression system design criteria.
- C. Fire Suppression Equipment: Refer to individual Division 21, Fire Suppression Sections for fire suppression equipment requirements.

1.5 Section Includes

- A. Work included in 21 00 00, Fire Suppression Basic Requirements applies to Division 21, Fire Suppression work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of fire protection systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:

1. Provide: To furnish and install, complete and ready for intended use.
2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete Item of work furnished.
4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent," substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted Item.
5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.6 Related Sections

- A. Content of Section applies to Division 21, Fire Suppression Contract Documents.

B. Related Work:

1. Additional conditions apply to this Division including, but not limited to:
 - a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
 - b. Drawings
 - c. Addenda
 - d. Owner/Architect Agreement
 - e. Owner/Contractor Agreement
 - f. Codes, Standards, Public Ordinances and Permits

1.7 References and Standards

- A. References and Standards per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, individual Division 21, Fire Suppression Sections and those listed in this Section.
- B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
 1. State of California:

- a. CBC - California Building Code
 - b. CEC - California Electrical Code
 - c. CEC T24 - California Energy Code Title 24
 - d. CFC - California Fire Code
 - e. CMC - California Mechanical Code
 - f. CPC - California Plumbing Code
 - g. CSFM - California State Fire Marshal
- C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
- 1. ABA - Architectural Barriers Act
 - 2. ADA - Americans with Disabilities Act
 - 3. AHRI - Air-Conditioning Heating & Refrigeration Institute
 - 4. ANSI - American National Standards Institute
 - 5. ASCE - American Society of Civil Engineers
 - 6. ASCE-7 Minimum Design Loads for Buildings and Other Structures
 - 7. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
 - 8. ASHRAE Guideline 0, the Commissioning Process
 - 9. ASME - American Society of Mechanical Engineers
 - 10. ASPE - American Society of Plumbing Engineers
 - 11. ASSE - American Society of Sanitary Engineering
 - 12. ASTM - ASTM International
 - 13. AWWA - American Water Works Association
 - 14. CFR - Code of Federal Regulations
 - 15. EPA - Environmental Protection Agency
 - 16. ETL - Electrical Testing Laboratories
 - 17. FCC - Federal Communications Commission
 - 18. FM - FM Global
 - 19. FM Global - FM Global Approval Guide
 - 20. IAPMO - International Association of Plumbing and Mechanical Official

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21. ICC - International Code Council
 22. IEC - International Electrotechnical Commission
 23. ICC-ESR - International Code Council Evaluation Service Reports
 24. HI - Hydraulic Institute Standards
 25. ISO - International Organization for Standardization
 26. MSS - Manufacturers Standardization Society
 27. NEC - National Electric Code
 28. NEMA - National Electrical Manufacturers Association
 29. NFPA - National Fire Protection Association:
 - a. NFPA 13 - Standard for the Installation of Sprinkler Systems
 - b. NFPA 24 - Standard for Installation of Private Fire Service Mains and Their Appurtenances
 - c. NFPA 25 - Standard for Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
 - d. NFPA 70 - National Electrical Code
 - e. NFPA 72 - National Fire Alarm and Signaling Code
 30. NRCA - National Roofing Contractors Association
 31. NSF - National Sanitation Foundation
 32. OSHA - Occupational Safety and Health Administration
 33. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.
 34. TIMA - Thermal Insulation Manufacturers Association
 35. UL - Underwriters Laboratories Inc.
- D. See Division 21, Fire Suppression individual Sections for additional references.

1.8 Submittals

- A. See Division 01, General Requirements for Submittal Procedures as well as specific individual Division 21, Fire Suppression sections.
- B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.
- C. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract

Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.

- D. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. Copy Architect on all transmissions/submissions.
- E. Submit shop drawings, calculations and product data sheets as one complete stand-alone package to AHJ, Owner's insurance underwriter and Engineer.
- F. Product Data: Provide Manufacturer's descriptive literature for products specified in Division 21, Fire Suppression Sections.
- G. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.
 - 1. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed Item. Highlight connections by/to other trades.
 - 2. Include technical data, installation instructions and dimensioned drawings for products, equipment and devices installed, furnished or provided. Reference Division 21, Fire Suppression specification Sections for specific Item required in product data submittal outside of these requirements.
 - 3. Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.
 - 4. For vibration isolation of equipment, list make and model selected with operating load and deflection. Indicate frame type where required. Submit manufacturer's product data.
 - 5. See Division 21, Fire Suppression Sections for additional submittal requirements outside of these requirements.
- H. Maximum of two reviews provided of complete submittal package. Arrange for additional reviews and/or early review of long-lead Item; Bear costs of additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
- I. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer's comments. Identify Engineer's comments and provide an individual response to each of the Engineer's comments. Cloud changes in the submittals and further identify changes which are in response to Engineer's comments.

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- J. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-16 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.
- K. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 21, Fire Suppression coordination documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical and Division 28, Electronic Safety submittals.
- L. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
- M. Substitutions and Variation from Basis of Design:
1. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
 2. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.
- N. Shop Drawings:
1. Provide coordinated Shop Drawings which include physical characteristics of all systems, equipment and piping layout, pipe layout, hanger layout, sway brace layout, seismic restraints, sway brace calculations, drains, location of drain discharge, risers, valves, details, water test information, physical device layout plans, and control wiring diagrams. Reference individual Division 21, Fire Suppression Sections for additional requirements for shop drawings outside of these requirements.
 2. Shop Drawings and hydraulics calculations, sway brace calculations, trapeze hanger calculations, and the like, to be prepared under the direct supervision and control of a Professional Engineer competent to do such work and licensed in the state of California. Drawings and calculations to bear the seal and wet signature of the professional Engineer.
 3. Provide Shop Drawings which indicate information required by NFPA 13. Include room names and fire sprinkler occupancy hazard classifications.

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4. Provide Shop Drawings illustrating information for Hydraulic Information Sign for each hydraulic remote area calculated.
5. Utilizing the Reflected Ceiling backgrounds, provide Shop Drawings illustrating locations of fire sprinklers and piping.
6. Utilizing the Structural backgrounds, provide Shop Drawings illustrating locations and types of hangers and sway braces.
7. Provide Shop Drawings illustrating each type of hanger, including fasteners to structure.
8. Provide Shop Drawings illustrating each type of branchline restraint and sway brace, including length of sway brace member, sway brace fittings, minimum and maximum angles from vertical of sway brace member, method of attachment to structure, size, length and embedment of attachment to structure and size and type of structural member to which sway brace will be attached. Number each type of restraint and sway brace. Indicate on Drawings locations of each type of numbered restraint and sway brace.
9. Provide details for any hanger, attachment, or sway brace to be attached to any I-joist, structural insulated panels (SIPs), cross laminated timber, and similar engineered structural products according to the specifications of the engineered product manufacturer.
10. Provide Shop Drawings illustrating information for Sprinkler System General Information Sign.
11. Shop Drawings to include a cross-sectional view that shows the sprinkler heads and piping in relation to the building's architectural and structural information. View to be chosen based on a location that will display the most information.
12. When required, provide Coordination Drawings.
13. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.
14. Provide details of hanger, sway bracing and branch line restraint attachments to structure and to piping. Include details on the size and load capacities of fasteners. Provide verification of the structural capacity to withstand seismic load.
15. Provide sway bracing calculations on drawings showing horizontal seismic design load and requirements, with indication of zone of influence for each bracing location.
16. Provide a schedule of sway bracing type, size, and design criteria, including length, angle from vertical, and load capacities.
17. Clearly indicate the elevation of the highest sprinkler in relation to the elevation of the flow test pressure gauge monitor hydrant.
18. Provide details of flexible sprinkler hose fitting per manufacturer's schedule of equivalent feet used in hydraulic calculations, showing device length, maximum number of 90-degree bends and expected radius of bends.
19. Provide a schedule of signage to be installed at each flexible sprinkler hose fitting.

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20. On the drawings, provide a list of number, model, temperature, sprinkler identification number, manufacturer, orifice, deflector type, thermal sensitivity and pressure rating, quantity of each type to be contained in the spare sprinkler cabinet and the issue date or revision date of the list."
 21. Spare sprinkler head cabinet size indicating the number of spare sprinkler head to be contained therein.
- O. Samples: Provide samples when requested by individual Sections.
- P. Resubmission Requirements:
1. Make any corrections or change in submittals when required. Provide submittals as specified. The Engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Clearly indicate changes on Drawings and cloud changes in the submittals.
 2. Resubmit for review until review indicates no exceptions taken or make "corrections as noted".
- Q. Operation and Maintenance Manuals/Owner's Instructions:
1. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or item requiring servicing. Include valve charts. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
 - a. Include copies of certificates of code authority acceptance, code-required acceptance tests; test reports and certificates.
 - b. Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Sections.
 - c. Catalog description of each item of equipment actually installed on job.
 - d. Instructions for operation and maintenance of fire suppression systems composed of operating instructions, maintenance instructions and manufacturer's literature as follows:
 - 1) Testing and Maintenance Schedule Chart: Provide an 8-1/2- by 11-inch typewritten list of each item of installed equipment requiring testing inspection , lubrication or service, describing and scheduling performance of maintenance.
 - 2) Manufacturer's Literature: Provide copies of manufacturer's instructions for operation and maintenance of fire suppression equipment, including replacement parts list with name and address of nearest distributor. Mark each copy with equipment identification label as listed in equipment schedule, i.e. F-5 etc.

- e. Include product certificates of warranties and guarantees.
 - f. Include Record Drawings,
 - g. Include copy of water supply flow test used as basis for hydraulic calculations.
 - h. Include hydraulic calculations and sway brace calculations.
 - i. Include Contractor's Material and Test Certificates for Aboveground Piping/Underground Piping.
 - j. Include a copy of NFPA 25.
 - k. Include a copy of valve charts and whether normally open or normally closed.
 - l. Include a copy of drain, auxiliary, and low point drains charts.
 - m. Include a copy of the list to be included in the spare sprinkler head box.
 - n. Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
 - o. Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, and quantities relevant to each piece of equipment: i.e. belts, motors, lubricants, and filters.
 - p. Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub-assemblies.
 - q. Include copy of startup and test reports specific to each piece of equipment.
 - r. Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.
2. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 21 00 00, Fire Suppression Basic Requirements, Article titled "Demonstration".
 3. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.
- R. Record Drawings:
1. Maintain at site at least one set of Drawings for recording "As-constructed" conditions. Indicate on Drawings changes to original documents by referencing revision document,

and include buried elements, location of cleanouts, and location of concealed mechanical Item. Include items changed by field orders, supplemental instructions, and constructed conditions.

2. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.
3. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD Files and drawings upon substantial completion.
4. Invert elevations and dimensioned locations for water services and drainage piping below grade extending to 5-feet outside building line.
5. Record Drawings to include site information or reference site information for complete understanding of the fire protection system between the building and the point of connection to the water supply and location of flow test pressure hydrants.
6. See Division 21, Fire Suppression individual Sections for additional items to include in Record Drawings.

S. Calculations: Submit hydraulic and sway brace and the like calculations.

1. Hydraulic Calculations:
 - a. Include friction losses between the hydraulically most remote design area and the hydrant flow test pressure hydrant.
 - b. Hydraulic calculations to be performed on a nationally recognized fire sprinkler hydraulic calculation computer program, with cover sheets in the format required by the latest edition of NFPA 13. Hydraulic calculations performed "by hand" or not on a nationally recognized fire sprinkler hydraulic calculations computer program will be returned without review by engineer.
 - c. Provide one or more hydraulic calculations for each hydraulically most remote area.
 - d. Where it is not obvious which area is most hydraulically remote, perform and submit for review additional hydraulic calculations proving the hydraulically most remote area.
 - e. For grid systems, either provide "peaked" hydraulic calculations, or provide two additional sets of hydraulic calculations for each hydraulically most remote area.
 - f. Include pressure losses between the highest sprinkler and the elevation of the pressure gauge monitor hydrant of the flow test.
 - g. Include friction loss for flexible branch line connectors per manufacturer's schedule of equivalent feet for device length, maximum number of bends and expected radius of bends.
 - h. When flexible sprinkler hose fittings are added to an existing system, provide hydraulic calculations verifying the design flow rate will be achieved."

- i. For Future Tenant Improvement Spaces: Include in hydraulic calculations friction loss allowances for future installation of flexible sprinkler head connectors so that flexible connectors may be installed in the future without revisions to the overhead system.

2. Sway Brace Calculations:

- a. Sway brace calculations utilizing a proprietary computer calculation program only used for the sway brace components supported by that manufacturer. For example, only "manufacturer X" sway brace components, and not those of another manufacturer, may be calculated on a "manufacturer X" sway brace computer calculation program.
- b. Provide seismic calculations for any sway brace to be attached to any I-joist, structural insulated panels (SIPs), cross laminated timber, and similar engineered structural products according to the specifications of the I-joist manufacturer.

1.9 Quality Assurance

- A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
- B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.
- C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.
- D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.
- E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
- F. Provide products that are UL listed.
- G. Piping Insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

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1.10 Warranty

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.
- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.11 Coordination Documents

- A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, plumbing equipment/fixtures, fire sprinklers, fire alarm, plumbing, cable trays, lights, and electrical services with architectural and structural requirements, and other trades (including fire alarm ceiling suspension and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, and finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.
- B. Advise Architect in the event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.
- C. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation.
- D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 Manufacturers

- A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to sprinkler heads, pipe, fittings, hangers and bracing materials.

2.2 Standards of Materials and Workmanship

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL, ETL, FM, ICC-ES, and CSFM approved for their intended fire protection function or have adequate approval or be acceptable by State, County, and City authorities.
- B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- C. Hazardous Materials:
 1. Comply with local, State of California, and Federal regulations relating to hazardous materials.

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2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.1 Accessibility and Installation

- A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.
- B. Install equipment requiring access (i.e. drains, control operators, valves, motors, engines, pumps, controllers, air compressors, gauges, fill cups, tanks, cleanouts and the like) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.

D. Earthwork:

1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with the following:
 - a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with the provisions specified. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
 - b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
 - c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:

1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection.
2. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM

International E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Pipe Installation:

1. Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building as well as anticipated settlement or shrinkage of building. Install work to prevent damage to piping, equipment, and building and its contents. Provide piping offsets, loops, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building with Project Structural Engineer. Verify construction phasing, type of building construction products and rating coordinating installation of piping systems.
2. Include provisions for servicing and removal of equipment without dismantling piping.

G. Plenums: Provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.

3.2 Seismic Control

- A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 21, Fire Suppression Sections.
- B. Provide fire suppression equipment and piping, both hanging and base mounted, with mounting connection points of sufficient strength to resist lateral seismic forces equal to lateral seismic forces as determined by building code and NFPA 13 calculations, whichever is more demanding.
- C. See Structural Drawings for seismic design criteria for sway bracing and seismic restraint.
- D. Earthquake resistant designs for Fire Protection (Division 21) equipment and distribution, i.e. fire sprinkler systems, fire standpipe systems, fire pumps, fire pump controllers, fire tanks, clean agent fire suppression systems, etc. to conform to regulations of jurisdiction having authority.
- E. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.
- F. Provide stamped Shop Drawings from licensed Engineer of seismic bracing and seismic movement assemblies for piping, equipment, tanks, pumps controllers and the like. Submit shop drawings along with equipment submittals.
- G. Provide stamped Shop Drawings from licensed Engineer of seismic flexible joints for piping and crossing building expansion or seismic joints. Submit Shop Drawings along with seismic bracing details.
- H. Provide details of flexible drops for sprinklers in conformance with Building Code and ASCE 7 requirements of ceilings. Coordinate with Architectural and Structural Drawings and Specifications.

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- I. Piping: Per NFPA 13, ASCE-7 and local requirements.
- J. Equipment:
 - 1. Per "Seismic Restraints Manual Guidelines for Mechanical Systems" latest edition published by SMACNA, ASCE 7 and local requirements.
 - 2. Provide means to prohibit excessive motion of fire protection equipment during an earthquake.

3.3 Review and Observation

- A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.
- B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
 - 1. Underground piping installation prior to backfilling.
 - 2. Prior to covering walls.
 - 3. Prior to ceiling cover/installation.
 - 4. When main systems, or portions of, are being tested and ready for inspection by AHJ.
 - 5. When mains or branchlines are to be permanently concealed by construction or insulation systems.
 - 6. When fire suppression systems, or portions of, are being tested and ready for inspection by AHJ.
- C. Bear responsibility and cost to make piping accessible, to expose concealed lines, or to demonstrate acceptability of the system. If Contractor fails to notify Architect at times prescribed above, costs incurred by removal of such work are the responsibility of the Contractor.
- D. Final Punch: Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 Continuity of Service

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and the following:
 - 1. During remodeling or addition to existing structures, while existing structure is occupied, current services to remain intact until new construction, facilities or equipment is installed.
 - 2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new piping, and wiring to point of connection.
 - 3. Coordinate transfer time to new service with Owner. If required, perform transfer during off peak hours. Once changeover is started, pursue to its completion to keep interference

at a minimum. If overtime is required, there will be no allowance made by Owner for extra expense for such overtime or shift work.

4. During entire time system, or part thereof, is not operational, provide a firewatch per Fire Code, including a watchperson whose sole duty is to watch for and report fires.
5. Organize work to minimize duration of power interruption.

3.5 Cutting and Patching

A. Confirm Cutting and Patching requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and the following:

1. Cutting and patching performed under Division 21, Fire Suppression includes, but is not limited to:
 - a. Cutting and patching of plaster or partitions.
 - b. Cutting and patching of finished ceilings.
2. Perform cutting and patching by skilled craftsmen in trade of work to be performed. Fill holes which are cut oversized for completed work. Match refinished areas with existing adjacent finish in a manner acceptable to Architect.
3. When masonry to concrete construction must be penetrated, provide a steel pipe sleeve in opening and grout in place in a neat manner. Leave grout surface to match existing finish. Provide escutcheons. If sleeves are not provided, core drill penetrations.
4. Locate concealed utilities to eliminate possible service interruption or damage.
5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.
6. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
7. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
8. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
9. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of

this project. Where alterations disturb lawns, landscaping, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.

10. Repair mutilation of building around pipes, equipment, hangers, and braces.

3.6 Equipment Selection and Serviceability

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing at no additional cost to Owner.

3.7 Delivery, Storage, and Handling

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and the following:

1. Handle materials delivered to project site with care to avoid damage and deterioration. Store materials in original containers which identify manufacturer, name, brand and model numbers on site inside building or protected from weather, sun, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.
2. Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
3. Protect bright finished shafts, bearing housings and similar item until in service.

3.8 Demonstration

- A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.
- B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.
- C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.
- D. Prior to acceptance of work and during time designated by Architect, provide necessary qualified personnel to operate system for a period of two hours.

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- E. Instruct the Owner in the operation of the sprinkler system, including main valve position (open or closed) recognition, system drainage, system testing, dry pipe valve reset and the relation to the fire alarm system.
- F. Upon completion of work and adjustment of equipment, test systems to demonstrate to Owner's Authorized Representative and Architect that equipment is furnished and installed or connected under provisions of these Specifications.

3.9 Cleaning

- A. Confirm Cleaning requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.
- B. Upon completion of installation, except for sprinklers, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.
- C. Sprinklers may not be cleaned except for vacuuming in a manner in which no part of the sprinkler is touched by the vacuuming equipment. Replace sprinklers which bear traces of foreign substances with sprinklers of same model, temperature, K-factor, orifice, finish, style, orientation, and the like.

3.10 Installation

- A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.
- B. Install equipment in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.
- C. Start-up equipment, in accordance with manufacturer's start-up instructions, in the presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment. Provide pump impellers to obtain Basis of Design design capacities.
- D. Provide miscellaneous supports/metals required for installation of equipment and piping.

3.11 Painting

- A. Confirm requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and the following:
 1. Ferrous Metal: After completion of fire protection work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
 2. After acceptance by Authority Having Jurisdiction (AHJ), in a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.

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3. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
4. Piping: Clean, primer coat and paint exposed piping on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Architect.
5. Covers: Covers such as vault covers and the like will be furnished with finishes which resist corrosion and rust.

3.12 Acceptance

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Sections in Division 21, Fire Suppression and the following:

1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
 - a. Testing reports including Contractor's Material and Test Certificate for Underground Piping, Contractor's Material and Test Certificate for Aboveground Piping, Contractor's Material and Test Certificate for Private Fire Service Mains, Fire pump acceptance test data report, and the like.
 - b. Cleaning
 - c. Operation and Maintenance Manuals
 - d. Training of Operating Personnel
 - e. Record Drawings
 - f. Warranty and Guaranty Certificates
 - g. Start-up/Test Document and Commissioning Reports
 - h. Letter of Conformance

3.13 Field Quality Control

- A. Confirm Field Quality Control requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.
- B. Upon completion of installation of equipment, sprinklers, hose valves and piping and after units are water pressurized, test system to demonstrate capability and compliance with requirements. When possible, correct malfunctioning Item at site, then retest to demonstrate compliance; otherwise remove and replace with new Item and proceed with retesting.
- C. Inspect each installed Item for damage to finish. If feasible, restore and match finish to original, except fire sprinklers, at site; otherwise, remove Item and replace with new Item. Feasibility and match to be judged by Architect. Remove cracked or dented Item and replace with new Item.

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- D. Fire sprinklers may not be reused, or cleaned, except for dusting. Replace damaged, field painted, oversprayed, overcoated or field coated sprinklers with new sprinklers of same manufacturer, model, finish, K-factor and performance characteristics. Where identical replacement sprinklers are not available, provide sprinklers of similar finish, style, K-factor and performance characteristics.
- 3.14 Letter of Conformance
- A. Provide Letter of Conformance and copies of manufacturers' warranties and extended warranties with a statement that fire suppression items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.
- 3.15 Electrical Interlocks
- A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize fire protection equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.
- 3.16 Connections to Existing
- A. Prior to connection of piping to existing piping or utilities, field verify existing conditions and exact sizes and locations of existing piping. Provide additional offsets, transitions, joints, cut-ins, and replace portions of existing as required to facilitate connections of new.

END OF SECTION

SECTION 21 0500
COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 Summary

A. Work Included:

1. Aboveground Black Steel Pipe and Fittings
2. Seismic Separation Assembly
3. Wall and Floor Penetrations and Sleeves
4. Hangers and Supports
5. Struts and Strut Clamps
6. Sway Braces and Restraints
7. Anchors and Attachments
8. Gauges
9. Bells
10. Valves
11. Pipe, Valve, and Fire Protection Equipment Identification
12. Signs
13. Drains

1.2 Related Sections

- A. Contents of Division 21, Fire Suppression and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
1. Division 22, Plumbing
 2. Division 23, Heating, Ventilating and Air Conditioning
 3. Division 26, Electrical
 4. Division 28, Electronic Safety
 5. Section 21 00 00, Fire Suppression Basic Requirements
 6. Section 21 13 00, Fire Suppression Sprinkler Systems

1.3 References and Standards

- A. References and Standards as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.
- B. Meet requirements of ASCE 7, Minimum Design Loads for Buildings and Other Structures, by American Society of Civil Engineers, latest adopted edition.

1.4 Submittals

- A. Submittals as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.5 Quality Assurance

- A. Quality assurance as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

- B. In addition, meet the following:

1. Material and Equipment: Listed for its intended fire protection use in current UL Fire Protection Equipment Directory, or UL Online Certifications Directory for Fire Protection, International Code Council Evaluation Service Reports and FM Global Approval Guide. All material and equipment to be new and from a current manufacturer.
2. Provide per AHJ requirements.
3. References to product Specifications for materials are listed according to accepted ANSI, ASTM, ASME, AWWA and other base standards. Materials to meet latest approved versions of these standards.
4. Fire Suppression Screw-Thread Connections: Comply with local fire department/fire marshal regulations for sizes, threading and arrangement of connections for fire department equipment to fire department connections.
5. Manufacturers: Unless an item is marked "No substitutions", submit substitution request for materials of other than named manufacturers.
6. Noise and Vibration:
 - a. Install vibration isolators and measures required to prevent noise and vibration from being transmitted to occupied areas. Select equipment to operate within noise coefficient (NC) design level for particular type of installation in relation to its location.
 - b. After installation, make proper adjustments to reduce noise and vibration to acceptable levels as defined by Architect.
 - c. In acoustically sensitive areas, design system in a manner that minimizes the number of wall penetrations.

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1.6 Warranty

- A. Warranty of materials and workmanship as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.7 Flow Test

- A. Provide materials and labor for a new water supply test on the closest nearby fire hydrants per NFPA 13 and NFPA 291. Base hydraulic calculations on new flow test.

1.8 System Impairment

- A. When returning a water-based fire protection system to service after impairment or control valve closure, verify the system is in working order by performing a main drain test per NFPA 25.

PART 2 - PRODUCTS

2.1 Manufacturers

- A. Aboveground Black Steel Pipe and Fittings:

1. Pipe:

- a. Bull Moose Tube
- b. Wheatland Tube Co.
- c. Youngstown Tube Co.
- d. Tex-Tube Co.
- e. State Pipe and Supply, Inc.
- f. Or approved equivalent

2. Fittings, Mechanical and Grooved Couplings:

- a. Victaulic
- b. Gruvlok
- c. Shurjoint Piping Products Inc.
- d. Smith-Cooper International
- e. Tyco Fire & Building Products
- f. Viking Corp.
- g. Allied Rubber and Gasket Co. Inc., dba ARGCO
- h. Anvil International
- i. Dixon Valve & Coupling
- j. Or approved equivalent.

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3. Fittings, Threaded:

- a. Ward Mfg.
- b. Anvil International
- c. Smith-Cooper International
- d. Aegis Technologies
- e. Or approved equivalent.

4. Fittings, Rubber Gasketed:

- a. Victaulic
- b. Anvil International
- c. AnvilStar
- d. EBAA Iron, Inc.
- e. Shurjoint Piping Products, Inc.
- f. Smith-Cooper International
- g. Tyco Fire & Building Products
- h. Viking Corp.
- i. Ward Mfg.
- j. Allied Rubber and Gasket Co. Inc., dba ARGCO
- k. Dixon Valve & Coupling
- l. Or approved equivalent.

5. Fittings, Welded:

- a. Anvil International
- b. Shurjoint Piping Products Inc.
- c. Smith-Cooper International
- d. State Pipe & Supply, Inc.
- e. Or approved equivalent.

6. Fittings, Flanged:

- a. Victaulic
- b. United Brand Fittings

- c. U.S. Pipe
- d. Anvil S.P.F.
- e. Iowa Fittings Co.
- f. Tyco Fire Products
- g. Or approved equivalent.

B. Seismic Separation Assembly:

- 1. Metraflex Fireloop
- 2. Anvil International
- 3. Unisource Mfg. Inc.
- 4. Mason Industries
- 5. Twin Cities Hose
- 6. Or approved equivalent.

C. Wall and Floor Penetrations and Sleeves:

- 1. Allied Rubber and Gasket Co., Inc., dba ARGCO
- 2. Fire Protection Products Inc. (FPPI)
- 3. Or approved equivalent.

D. Hangers and Supports:

- 1. Cooper B-Line Tolco
- 2. Anvil International
- 3. ITW Buildex Sammys
- 4. Erico International
- 5. PHD Mfg. Inc.
- 6. Or approved equivalent.

E. Struts and Strut Clamps:

- 1. Cooper B-Line Tolco
- 2. Or approved equivalent.

F. Sway Braces and Restraints:

- 1. Cooper B-Line Tolco

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2. Anvil International
3. Erico International
4. PHD Mfg. Inc.
5. Or approved equivalent.

G. Anchors and Attachments:

1. Concrete:

- a. Cast-In Place Anchors for Hangers:
 - 1) Cooper B-Line Tolco
 - 2) Erico International
 - 3) Or approved equivalent.

- b. Cast-In Place Anchors for Braces:
 - 1) Cooper B-Line Tolco
 - 2) Anvil International
 - 3) Erico International
 - 4) Or approved equivalent.

- c. Attachments as specified or described by structural. If not specified or described by structural, then as follows:
 - 1) Hilti
 - 2) Powers
 - 3) Simpson Strong-Tie
 - 4) DeWalt
 - 5) Or approved equivalent.

2. Wood:

- a. Cooper B-Line Tolco
- b. Anvil International
- c. Elco Construction Products
- d. Erico International
- e. ITW Buildex Sammys
- f. Or approved equivalent.

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3. Steel:

- a. Cooper B-Line Tolco
- b. Anvil International
- c. Elco Construction Products
- d. Erico International
- e. ITW Buildex Sammys
- f. Or approved equivalent.

H. Gauges:

1. Ashcroft
2. US Gauge
3. Brecco
4. Reliable Automatic Sprinkler Co.
5. Fire Protection Products, Inc. (FPPI)
6. Allied Rubber and Gasket Co. Inc., dba ARGCO
7. Wika Instrument Corp.
8. Or approved equivalent.

I. Bells:

1. Potter
2. System Sensor
3. Or approved equivalent.

J. Valves:

1. OS&Y Gate:
 - a. Victaulic
 - b. Nibco
 - c. Mueller
 - d. Or approved equivalent.
2. NRS Gate:
 - a. Nibco

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- b. Mueller
- c. Victaulic
- d. Or approved equivalent.

3. Swing Check:

- a. Victaulic
- b. Nibco
- c. Mueller
- d. Viking
- e. Tyco
- f. AnvilStar
- g. Reliable
- h. Or approved equivalent.

4. Wafer Check:

- a. Nibco
- b. Mueller
- c. Viking
- d. Tyco
- e. Or approved equivalent.

5. Butterfly Valves:

- a. Victaulic
- b. Nibco
- c. Tyco
- d. Use lug body next to pumps; Nibco.
- e. Reliable
- f. Or approved equivalent.

6. Pressure Relief:

- a. Watts
- b. United Brass Works

- c. AGF
 - d. Or approved equivalent.
7. Automatic Ball Drip Drain Valve:
- a. Tyco
 - b. Reliable Automatic Sprinkler Co.
 - c. Or approved equivalent.
8. Three-Way Gauge Valve:
- a. Fire Protection Products Inc. (FPPI)
 - b. AGF Mfg. Inc.
 - c. Nibco
 - d. Or approved equivalent.
9. Automatic Air Release Valve:
- a. Potter Electric Signal Co.
 - b. Or approved equivalent.
10. Ball Valve:
- a. Victaulic
 - b. Apollo Valves
 - c. Fire Protection Products Inc. (FPPI)
 - d. Nibco
 - e. Or approved equivalent.
- K. Pipe, Valve, and Fire Protection Equipment Identification:
- 1. Fire Protection Products, Inc. (FPPI)
 - 2. Allied Rubber and Gasket Co., Inc., dba ARGCO
 - 3. Or approved equivalent.
- L. Signs:
- 1. Tyco Fire Products
 - 2. Reliable Automatic Sprinkler
 - 3. Viking Corp.

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4. Allied Rubber and Gasket Co., Inc., dba ARGCO
5. Or approved equivalent.

M. Drains:

1. Reference Aboveground Black Steel Pipe and Fittings.
2. AGF
3. Victaulic
4. Or approved equivalent.

2.2 Aboveground Black Steel Pipe and Fittings

A. Wet Pipe Systems:

1. Pipe Size 2-inch Diameter and Smaller: ASTM A53, ASTM A135, or ASTM A795; minimum of Schedule 40.
2. Pipe Size 2-1/2-inch Diameter and Larger: ASTM A53, ASTM A135, or ASTM A795; minimum of Schedule 10.
3. Exposed pipe 8-feet or less above finished floor: A minimum of Schedule 40.

B. Dry Pipe Systems:

1. Pipe Size 2-inch Diameter and Smaller: ASTM A53, ASTM A135, or ASTM A795; Schedule 40 only, shop welded, or threaded or cut grooved.
2. Pipe Size 2-1/2-inch Diameter and Larger: ASTM A53, ASTM A135, or ASTM A795; minimum of Schedule 10.
3. Exposed pipe 8-feet or less above finished floor: Minimum of Schedule 40.

C. Joints:

1. Threaded, flanged or bevel welded.
2. Piping installed in plenums or shafts to have welded joints.

D. Fittings:

1. Threaded:
 - a. Malleable Iron: Class 150 and Class 300, ANSI B16.3.
 - b. Cast Iron: Class 125 and 250, ANSI B16.3.
2. Flanged:
 - a. Cast iron; Class 125 and 250, ASME B16.1.
 - b. Raised ground face, bolt holes spot faced.

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3. Welded:

- a. Carbon Steel: Long radius, standard weight or extra strong.
- b. Factory Wrought Steel Butt weld Fittings: ASME B16.9.
- c. Butt welding Ends for Pipe, Valves, Flanges and Fittings: ASME B16.25.
- d. Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures: ASTM A234.
- e. Steel Pipe Flanges and Flanged Fittings: ASME B16.5.
- f. Forged Steel Fittings, Socket Welded and Threaded: ASME B16.11.

4. Mechanical Fittings and Grooved Couplings:

- a. Couplings: UL 213, AWWA C606, ASTM A536 ductile iron or ASTM A47 malleable iron, with enamel finish and grooves or shoulders designed to accept grooved couplings. Synthetic-rubber gasket with central-cavity, pressure-responsive design and ASTM A183 carbon-steel bolts and nuts.
- b. FM Global approved.

E. Anti-Microbial Coating: Factory-applied coating to inhibit corrosion from microbiological organisms.

2.3 Seismic Separation Assembly

- A. Flexible expansion loop, designed for seismic movement for sprinkler pipe passing through or crossing building seismic joints. Impart no thrust loads to building structure.
- B. Two flexible sections of hose and braid, two 90 degree elbows and 180 degree return. Factory supplied, center support nut located at the bottom of the 180 degree return, drain/air release plug. Provide materials of construction and end fitting type consistent with pipe material and equipment/pipe connection fittings.

2.4 Wall and Floor Penetrations and Sleeves

- A. Below Grade and High Water Table Areas: Waterproof elastomeric compound.

2.5 Hangers and Supports

- A. General: Select size of hangers and supports to exactly fit pipe size for bare piping.
- B. Hangers: Ferrous.
- C. Hanger Rods: Zinc electroplated carbon steel.
- D. Finishes: Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- E. Materials:

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1. Use carbon steel pipe hangers and supports, metal trapeze pipe hangers and attachments for general service applications.
 2. Use stainless steel hangers, rods and attachments for corrosive environment applications. Examples of corrosive environment applications include, but are not limited to: swimming pools and spas, pool and spa equipment rooms and adjacent areas, chemical rooms, kidney dialysis areas, marine and beach environments, commercial laundries and the like.
- F. Anti-Scratch Padding: Use padded hangers for piping subject to scratching.
- 2.6 Struts and Strut Clamps
- A. Electro-galvanized steel.
 - B. Designed for supporting pipe runs from strut supports.
 - C. Strut clamps UL listed for fire protection.
 - D. Stainless steel for corrosive environment applications. Examples of corrosive environment applications include, but are not limited to: swimming pools and spas, pool and spa equipment rooms and adjacent areas, chemical rooms, kidney dialysis areas, marine and beach environments, commercial laundries and the like.
- 2.7 Sway Braces and Restraints
- A. Sway Bracing: From a single manufacturer and compatible with sway brace calculation program.
 - B. Stainless steel for corrosive environment applications. Examples of corrosive environment applications include, but are not limited to: swimming pools and spas, pool and spa equipment rooms and adjacent areas, chemical rooms, kidney dialysis areas, marine and beach environments, commercial laundries, and the like.
- 2.8 Anchors and Attachments
- A. General: Anchor supports to masonry, concrete and block walls per anchoring system manufacturer's recommendations, or as modified by project Structural Engineer.
 - B. Materials:
 1. Ferrous.
 2. Stainless steel for corrosive environment applications. Examples of corrosive environment applications include, but are not limited to: swimming pools and spas, pool and spa equipment rooms and adjacent areas, chemical rooms, kidney dialysis areas, marine and beach environments, commercial laundries, and the like.
 - C. Cast in Place Anchors for Hangers: Verify listing is for hangers, braces, or both.
 - D. Attachments in Concrete:
 1. Suitable for hanging and bracing fire protection systems in concrete which is subject to cracking in a seismic event.

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2. Seismic Design Areas C, D, E and F:

- a. Compatible with International Code Council Evaluation Service Acceptance Criteria AC-193 and AC308 for expansion, screw and adhesive anchors. Meet requirements of ACI 355.2, Qualification of Post-Installed Mechanical Anchors in Concrete and Commentary.
 - b. All models of Hilti HDI and ITW Red Head Multi-Set II anchors are not approved for attaching fire protection systems in Seismic Design Areas C, D, E and F. No Exceptions.
- E. ITW Buildex Sammys with FM Approval only are not allowed in certain seismic zones. Verify with FM that FM Approval is effective in project's seismic zone.

2.9 Gauges

- A. Pressure Gauges: 3.5-inch, dial type, bronze bourdon tube or spring type, stainless steel case. 0 to 300 PSI.

2.10 Bells

- A. Exterior Alarm Bells: Minimum weatherproof backbox, typical 90 dBA at 10-feet.
- B. Provide sign that reads, "When Bell Rings - Call 911".

2.11 Valves

- A. OS&Y Gate:
 1. 2-1/2-inches and Larger: Iron body.
 2. 2-inches and Smaller: Bronze body.
- B. NRS Gate:
 1. Iron body. Non-rising stem with indicator post.
 2. Underground Butterfly Valves: Telescopic barrel type.
- C. Swing Check: Iron body, rubber and bronze faced checks.
- D. Wafer Check: Iron body, rubber seat, spring actuated.
- E. Butterfly Valves: Ductile iron body with factory-installed tamper switches. Use lug body next to pumps.
- F. Pressure Relief: Bronze body, stainless steel spring.
- G. Automatic Ball Drip Drain Valve: Bronze, spring-type.
- H. Three-Way Gauge Valve: Brass; rated to 300 psi.
- I. Automatic Air-Release Valve for Wet Systems:
 1. Rated to 175 psi.

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2. Automatic float-type with shutoff mounted in a water retention pan.
 3. Single set 24VAC@2A for electronic supervision.
 4. Ball valve switch with cover tamper.
 - J. Ball Valves: Brass body, brass stem; forged brass ball disc.
- 2.12 Pipe, Valve, and Fire Protection Equipment Identification
- A. Engraved plastic laminate or corrosion resistant metal sign or plastic equipment marker.
 - B. Corrosion-resistant chain or permanent adhesive.
- 2.13 Signs
- A. Engraved plastic laminate or corrosion resistant metal sign or plastic equipment marker.
 - B. Corrosion-resistant chain or permanent adhesive.
- 2.14 Drains
- A. Reference Aboveground Black Steel Pipe and Fittings.

PART 3 - EXECUTION

- 3.1 General Installation Requirements
- A. Install in conformance with UL Listing, FM Approval or ICC-ES requirements and restrictions.
- 3.2 Aboveground Black Steel Pipe and Fittings
- A. Piping Routing:
 1. Route piping, except as otherwise indicated, vertically and horizontally (sloped to drain). Avoid diagonal runs wherever possible. Orient horizontal routes parallel with walls and beam lines.
 2. Install piping as shown or described by diagrams, details and notations on Drawings or, if not indicated, install piping to provide the shortest route which does not obstruct usable space or block access for servicing the building and its equipment.
 3. Install piping in concealed spaces above finished ceilings. Prior to design and installation, obtain pre-approval by Architect for exposed piping.
 4. In open-to-structure areas which are open to public view, route exposed piping to minimize visual impact. Obtain Architect's and Engineer's approval of exposed piping installation.
 5. Coordinate installation with other trades. Route piping as required to avoid building structure, equipment, plumbing piping, HVAC piping, ductwork, lighting fixtures, electrical conduits and bus ducts and similar work. Final location of lighting will have priority over final sprinkler locations. Provide drains to trapped sections of system which result from such routing. Other trades take precedence for installation space.

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6. Support piping adjacent to walls, overhead construction, columns and other structural and permanent enclosure elements of the building. Limit clearance to 2-inches wherever furring is indicated for concealment of piping. Allow for insulation thickness. Locate insulated piping to provide minimum 1-inch clearance outside insulation.
7. Wherever possible in finished and occupied spaces, conceal piping from view by locating within column or beam enclosures, hollow wall construction, or above suspended ceilings. Do not encase horizontal routes in solid partitions, except where approved.
8. General Electrical Equipment Clearances: Do not route piping through electrical rooms, transformer vaults, elevator equipment rooms and other electrical or electronic equipment spaces and enclosures. Do not route piping above electric power or lighting panel, switchgear, low voltage panel, or similar electric device.
9. Rooms Protected by Alternative Systems: Route water filled and dry system piping around rooms protected by pre-action systems, clean agent systems, gaseous suppression systems and other alternative fire suppression systems.
10. Install pipe runs to minimize obstruction to other work.
11. Pitch all dry and pre-action system piping 1/4-inch per 10-feet for mains and 1/2-inch per 10-feet for branch lines, including pipe passing through both warm and cold areas.

B. Couplings:

1. Install where indicated on Drawings and on each side of pieces of equipment to permit easy removal of equipment.
2. Deburr cut edges.

C. Pipe Penetrations: Wire pipe cutout coupon at point of pipe penetration.

D. Pipe and Pipe Fittings:

1. Expansion and Flexibility: Install work with due regard for expansion and contraction to prevent damage to the piping, equipment, building and its contents. Provide piping offsets, loops, approved type expansion joints, sway bracing, wire restraints, vertical restraints, flexible couplings or other means to control pipe movement and to minimize pipe forces.
2. Coordinate support of pipe 4-inches and larger with Structural Engineer.
3. Provide clearances around piping per NFPA 13.
4. Install dry and pre-action welded pipe with welds facing vertically up, or where this is not possible, as close as possible to vertical between 46 degrees and 234 degrees. Intent is to minimize corrosion caused by moisture in the bottom of pipes.

3.3 Seismic Separation Assembly

- A. Provide four-way sway braces upstream and downstream within 6-feet of the seismic separation assembly, attached to structure on opposite sides of the seismic joint. Do not attach bracing to seismic separation assembly.

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3.4 Wall and Floor Penetrations and Sleeves

- A. Escutcheons: Install on exposed pipes passing through walls or floors.
 1. Pipe Sleeves: Lay out work in advance of pouring concrete and furnish and set sleeves necessary to complete work.
 2. Floor Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Extend sleeve 1-inch above finished floor. Caulk pipes passing through floor with nonshrink fire and water resistant grout or approved equivalent caulking compound. Caulk/seal piping passing through fire rated building assembly with UL rated assemblies. Provide fire-rated assemblies per local AHJ requirements.
 3. Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk pipes passing through walls with non-shrinking caulking compound. Caulk/seal piping passing through fire-rated building assemblies with UL Listed or FM Approved fire-rated firestopping compound. Provide fire-rated assemblies per local AHJ requirements.
 4. Beam Sleeves:
 - a. Coordinate with trades for locations of pipe sleeves in reinforced concrete and steel beams. Penetrations must be indicated on structural shop drawings. See Drawings and Specifications for specific sleeve location limitations. Pipe sleeve locations must be indicated on reinforced concrete and steel beam shop drawings.
 - b. Field cutting of beams not allowed without written approval of structural engineer. No extra costs allowed for failure to coordinate beam penetrations prior to reinforced concrete and steel beam shop drawing submittal.
 5. Penetrations in Fire-Rated Wall/Floor Assemblies:
 - a. Reference Division 07, Thermal and Moisture Protection.
 - b. Coordinate with Drawings location of fire rated walls, ceilings and floors. When these assemblies are penetrated, seal around piping and equipment with approved firestopping material.
 - c. Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814 and NFPA.
 - d. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814.

3.5 Hangers and Supports

- A. Installation of pipe hangers, inserts and supports to conform to NFPA 13. Provide adjustable hangers, inserts, brackets, clamps, supplementary steel and other accessory materials required for proper support of pipe lines and equipment. Provide supplementary materials for proper support and attachment of hangers.

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3.6 Struts and Strut Clamps

- A. Install per manufacturer's listed orientation.

3.7 Sway Braces and Restraints

- A. Locate per orientation and spacing as required by sway brace calculations.
- B. Attach sway bracing directly to pipe or equipment being braced.
- C. Do not attach sway bracing to bottom of truss members.

3.8 Anchors and Attachments

- A. In post-tension construction, determine location of post-tension cables and install anchors to avoid contact or interference with post-tension cables. Coordinate with Structural.
- B. Do not use powder-driven attachments.
- C. Building Attachments and Inserts: Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves and flanges, for sizes NPS 2-1/2 and larger. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- D. Hanger and Support Attachments:

1. Concrete:

- a. Before Pouring: Prior to installation, coordinate locations of cast in place concrete inserts with other trades. Install in accordance with manufacturer's instructions.

b. After Pouring:

- 1) Where supports in slabs are required after concrete has been poured, provide drilled-in threaded inserts (mechanical-expansion anchors), installed in accordance with manufacturer's recommendations.
- 2) Install mechanical-expansion anchors after concrete is completely cured and in accordance with manufacturer's installation instructions.
- 3) Where anchors are to be installed in post-tension construction, determine and avoid locations of post-tension cables prior to drilling.

2. Metal Floor Deck: Support hangers per UL Listing or FM Approval for selected concrete insert before pouring of concrete topping, or from beam clamps fastened to structural steel.

3. Steel Joists: Support hangers from beam clamps fastened to bar joists or to auxiliary steel between bar joists as required.

4. C-Clamp Hangers: Do not attach to one side of double-angle bottom members.

5. Locate and install hangers, supports and attachments connecting to I-joists, structural insulated panels (SIPs), cross laminated timber and similar engineered structural

products according to the structural product manufacturer specifications.

- E. Make available to the Architect information required to verify the anchorage, sway bracing and restraint of fire protection systems.

3.9 Gauges

- A. Install gauges conveniently and accessibly located with reference to finished building for repairs, removal and service.
- B. Install with dial positioned for maximum visibility.

3.10 Bells

- A. Locate exterior alarm bells at 8-feet above finished grade. Coordinate with Architect.
- B. Coordinate with Divisions 26, Electrical and Division 28, Electronic Safety.

3.11 Valves

- A. General:
1. Provide post indicator on buried control valves.
 2. Inspect valves for leaks. Adjust or replace packing to stop leaks. Replace valve if leak persists.
- B. Installation:
1. Install valves where required for proper operation, testing and drainage. Locate valves so as to be accessible and so that separate support can be provided when necessary. Install conveniently and accessibly located with reference to finished building for repairs, removal and service.
 2. Swing Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to centerline of pipe. Install for proper direction of flow.
 3. Wafer Check Valves: Install between two flanges in horizontal or vertical position, position for proper direction of flow.
- C. Pressure Relief Valves: Provide piping to permanent drain.

3.12 Pipe, Valve, and Fire Protection Equipment Identification

- A. Install engraved plastic laminate or corrosion resistant metal sign or plastic equipment marker, secured with corrosion-resistant chain or permanent adhesive on or near each item of fire suppression equipment and each operational device, as specified in this specification if not otherwise specified for each item or device.
- B. Provide signs for the following general categories of equipment and operational devices: Valves, drains, pumps, standpipes, tanks and similar equipment.
- C. Each new piece of equipment to bear a permanently attached identification plate, listing manufacturer's name, capacities, sizes and characteristics.

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- D. Piping to bear the manufacturer's name, schedule of thickness, size and ASTM identification number
- E. Provide valve tag on every valve, control device, main drain, auxiliary drain, and drum drip in each system. Exclude check valves and valves within factory fabricated equipment units. List each tagged valve in valve schedule for each piping system.
- F. List each tagged item and its location in valve schedule; identify on fire suppression drawings.
- G. Install framed, glass or rigid transparent plastic covered, mounted valve schedule and valve location drawing in main riser or fire pump room.
- H. Provide identification sign on ceiling tile below valve location.
- I. Provide permanent identification sign at pressure regulating valves stating required setting of pressure regulator.
- J. Adjusting: Relocate fire suppression identification device which has become visually blocked.
- K. Cleaning: Clean face of identification devices and glass frames of valve charts.

3.13 Signs

- A. General Information Signs: Provide a general information sign used to determine system design basis and information relevant to the inspection, testing and maintenance requirements required by NFPA 25, Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems. Such general information is to be provided with a permanently marked weatherproof metal or rigid plastic sign, secured with corrosion-resistant wire, chain, or other acceptable means. Such signs are to be placed at each system control rise loop and auxiliary system control valve. The sign is to include the following information:
 - 1. Name and Location of the Facility Protected
 - 2. Presence of High-Piled and/or Rack Storage
 - 3. Maximum Height of Storage Planned
 - 4. Flow Test Data
 - 5. Location of Auxiliary Drains and Low Point Drains
 - 6. Original Results of Main Drain Flow Test
 - 7. Name of Installing Contractor or Designer
 - 8. Indication of presence and location of other auxiliary systems.

- B. Dry Signs: At system riser supplying dry systems, provide the following information: volume in gallons contained in each system.

3.14 Drains

- A. Locate drain connections within 7-feet of floor. Provide piping capable of being fully drained.
- B. Provide a drain vent at top of vertical drains. Coordinate with Division 22, Plumbing.

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- C. Coordinate location of auxiliary drains with Architect. Architect to approve location before drain is installed.
- D. Protect drains from tampering and accidental operation.
- E. Protect drain discharge at the exterior with a turned-down 45 degree elbow.

END OF SECTION

SECTION 21 1300
FIRE SUPPRESSION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 Summary

- A. Work Included:**
 - 1. Sprinklers
 - 2. Flexible Sprinkler Hose Fitting Assembly - For fire sprinklers in suspended ceilings which are supplied by a wet pipe system.
 - 3. Riser Manifold
 - 4. Wet System Air Vent
 - 5. Spare Sprinkler Cabinet
 - 6. Sprinkler Guards
- B. This is a contractor designed system. Contact AHJ prior to bid to verify fire system requirements. Provide design compliant with codes as interpreted by AHJ.**
- C. Scope:**
 - 1. Revision and extension of existing sprinkler system to remodeled areas and new office, attic, and conference spaces.
 - 2. Provide at least one coordination meeting with Architect prior to shop drawing submittal to coordinate sprinklers, piping, drain and test connection locations, details and the like.
- D. Coordinate location and type of tamper, flow and pressure switches and fire alarm system.**
- E. Provide electrical connections and wiring as required for a complete and operable system. Includes but is not limited to bells, air compressors, sump pumps, fire pumps, jockey pumps and pump controllers.**

1.2 Related Sections

- A. Contents of Division 21, Fire Suppression and Division 01, General Requirements apply to this Section.**
- B. In addition, reference the following:**
 - 1. Division 22, Plumbing
 - 2. Division 23, Heating, Ventilating and Air-Conditioning
 - 3. Division 26, Electrical
 - 4. Division 28, Electronic Safety
 - 5. Section 21 00 00, Fire Suppression Basic Requirements

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6. Section 21 05 00, Common Work Results for Fire Suppression

1.3 References and Standards

- A. References and Standards as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.4 Submittals

- A. Submittals as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Hydraulic calculations.
2. Sway brace calculations.
3. Details of sway bracing.
4. Details of interval and end of branch line restraints.
5. Details of flexible sprinkler hose fitting assembly, including number and radius of bends, corresponding to equivalent feet used in hydraulic calculations. Provide details of sign to be installed at each flexible sprinkler hose fitting assembly.
6. Details of oversized ceiling penetrations and oversized sprinkler escutcheons.
7. Trapeze hanger details and calculations, including size, length and material. Additionally, provide size, weight and number of pipes to be carried on the trapeze.
8. On submittal and As-Built drawings, provide text of sprinkler list to be installed in the spare sprinkler cabinet.

1.5 Quality Assurance

- A. Quality assurance as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.6 Warranty

- A. Warranty of materials and workmanship as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.7 System Description

- A. Provide coverage for building areas of remodel. Field verify field conditions prior to submittal of bid. Adjust bid to provide protection features in accordance with applicable codes and interpretations by AHJ. Provide design and installation based on more stringent requirements if this specification and AHJ requirements differ from Code.

B. Design Parameters:

1. Building Areas: Conference rooms, offices, attic space.

- a. Occupancy Classification: Light.
- 2. Building Areas: Mechanical rooms, storage rooms.
 - a. Occupancy Classification: Ordinary Group 1.
- 3. Design parameters above are NFPA 13 minimums. Provide increased design densities, design areas and hose allowances to meet requirements of AHJ.
- C. Sprinkler system design to include a 10 percent pressure and flow cushion between system demand point and available water supplies.
- D. Extend hydraulic calculations from hydraulically most remote design area back to location of pressure hydrant of flow test or effective point of water supply where characteristics of water supply are known.

1.8 Extra Stock

- A. Provide extra sprinklers per code.
- B. Provide suitable wrenches for each sprinkler type and metal storage cabinet in riser room.

PART 2 - PRODUCTS

2.1 Manufacturers

- A. Sprinklers:
 - 1. Finished Areas:
 - a. Victaulic
 - b. Viking
 - c. Tyco
 - d. Reliable
 - e. Globe
 - f. Senju
 - g. Or approved equivalent.
 - 2. Nonfinished Areas:
 - a. Victaulic
 - b. Viking
 - c. Tyco
 - d. Reliable
 - e. Globe

f. Or approved equivalent.

B. Flexible Sprinkler Hose Fitting Assembly:

1. Victaulic; VicFlex.
2. Flexhead Industries
3. SprinkFLEX
4. Allied Rubber and Gasket Company, Incorporated, dba ARGCO
5. Reliable Automatic Sprinkler Company
6. Tyco Fire and Building Products
7. Viking Corporation
8. Or approved equivalent.

C. Riser Manifold:

1. Viking EasyPac
2. Reliable; Model CR.
3. AGF; Model 8011.
4. Tyco; Model RM-1
5. Or approved equivalent.

D. Wet System Air Vent:

1. Potter Electric Signal Company; Model PAV
2. Or approved equivalent.

E. Spare Sprinkler Cabinet:

1. Victaulic
2. Fire Protection Products, Inc. (FPPI).
3. Tyco Fire & Building Products
4. Allied Rubber and Gasket Co.
5. Potter Roemer Fire Pro.
6. Or approved equivalent.

F. Sprinkler Guards:

1. Victaulic

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2. Viking
3. Tyco
4. Reliable
5. Globe
6. Senju
7. Or approved equivalent.

2.2 Sprinklers

A. Finished Areas:

1. Type: Glass-Bulb
2. Style: Concealed
3. Response: Quick-Response
4. Finish: White Polyester
5. Escutcheon: White Polyester
6. Coverplate for Concealed Sprinklers:
 - a. Flat Plate
 - b. White at areas of white ceilings. Match ceiling color in areas of colored ceilings, or as coordinated with architect.

B. Nonfinished Areas:

1. Type: Glass-Bulb
2. Response: Quick-Response
3. Finish: Match finish of existing sprinklers in area, or as directed by architect.

C. Pendent sprinklers supplied by dry or preaction piping: Dry pendent type.

2.3 Flexible Sprinkler Hose Fitting Assembly

- A. Fully welded non-mechanical fittings, stainless steel, braided, leak-tested with minimum 1-inch true-bore internal corrugated hose diameter. 175 psi.
- B. Ceiling Bracket: Galvanized steel, direct attachment type, with integrated snap-on clip ends and removable flexible hose attachment with set screw. FM1637, UL 2443.
- C. Affix permanent sign, label or decal at each flexible sprinkler hose fitting assembly anchoring component limiting the relocation of the sprinkler.

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2.4 Riser Manifold

- A. Water-flow alarm, gauge, integral pressure relief valve connected to drain, pressure gauge with 3-way gauge control valve and drain valve, integral pressure relief valve connected to drain, sight glass, smooth bore orifice union of same size as smallest orifice sprinkler installed. Provide cover tamper switch when required by AHJ.

2.5 Wet System Air Vent

- A. Brass, UL 2573 with ball valve supervisory switch.

2.6 Spare Sprinkler Cabinet

- A. NFPA 13 Systems: Sized to accommodate a minimum of two spare sprinklers of each Sprinkler Identification Number (SIN), manufacturer, model, orifice, deflector type, temperature and thermal sensitivity, or a minimum of six sprinklers for facilities having under 300 sprinklers, or a minimum of 12 sprinklers for facilities having 300 to 1000 sprinklers, or a minimum of 24 sprinklers for facilities having over 1000 sprinklers, whichever is more.

- B. Welded steel with hinged steel cover.

- C. Red enamel or polyester coated finish inside and out.

2.7 Sprinkler Guards

- A. Metal.

- B. Listed for use with sprinkler model to which it is attached.

PART 3 - EXECUTION

3.1 General Installation Requirements

- A. Install per manufacturer's requirements and recommendations.

3.2 Sprinklers

- A. Center sprinklers in center or quarter points of suspended ceiling tile.

- B. Align sprinklers with architectural column lines, lighting, diffusers and other ceiling features. In unfinished ceilings, route piping to minimize visual impact. Sprinklers and piping not so aligned are to be removed and replaced at no additional cost to Owner.

- C. Install dry sprinklers in a manner which does not trap water.

3.3 Flexible Sprinkler Hose Fitting Assembly

- A. Install flexible sprinkler hose fitting assemblies where pendent sprinkler heads are located in acoustic ceiling tiles.

- B. Install with no more bends than are included in equivalent footage used in hydraulic calculations.

- C. Maintain manufacturer's recommended bending radius as included in equivalent footage used in hydraulic calculations.

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- D. Affix permanent sign, label or decal at each flexible sprinkler hose fitting assembly anchoring component limiting the relocation of the sprinkler.

3.4 Riser Manifold

- A. Install so valves and gauges are conveniently and accessibly located with reference to finished building for repairs, removal and service.
- B. Provide connection to drain.
- C. Pipe pressure relief valve to drain.
- D. Install with supervised control valve(s) and check valve.

3.5 Wet System Air Vent

- A. Locate at a point in the system that will vent the most air.
- B. Connect at top of pipe.
- C. Locate so as not to interfere with sprinkler spray pattern.
- D. Locate where it can be easily accessed for inspection and cleaning.
- E. Pipe output of air vent to drain with an indirect connector or to exterior where it will not cause damage.

3.6 Spare Sprinkler Cabinet

- A. Attach to wall at the main sprinkler system riser.
- B. Locate so cover is easy to open and readily accessible.
- C. Locate in an area with a temperature between 40 and 100 degrees Fahrenheit.
- D. Locate sprinkler wrenches inside cabinet.
- E. Inside the cabinet, provide a list of sprinklers installed in the property, including sprinkler identification number, manufacturer, model, orifice, deflector type, thermal sensitivity and pressure rating, quantity of each type to be contained in the cabinet and issue or revision date of the list.

3.7 Sprinkler Guards

- A. Install per manufacturer's instructions and recommendations.

END OF SECTION

SECTION 23 0000
HEATING, VENTILATING AND AIR CONDITIONING (HVAC) BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Work included in 23 00 00, HVAC Basic Requirements applies to Division 23, HVAC work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of heating, ventilating and air conditioning systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.
- C. Definitions:
 - 1. Provide: To furnish and install, complete and ready for intended use.
 - 2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
 - 3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work provided.
 - 4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.
 - 5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.2 RELATED SECTIONS

- A. Contents of Section applies to Division 23, HVAC Contract Documents.
- B. Related Work:
 - 1. Additional conditions apply to this Division including, but not limited to:
 - a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
 - b. Drawings
 - c. Addenda
 - d. Owner/Architect Agreement

- e. Owner/Contractor Agreement
- f. Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

- A. References and Standards per Division 01, General Requirements, individual Division 23, HVAC Sections and those listed in this Section.
- B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
 - 1. State of California:
 - a. CALGreen - California Green Building Standards Code (CCR, Title 24, Part 11)
 - b. CBC - California Building Code
 - c. CEC - California Electrical Code
 - d. CEC T24 - California Energy Code Title 24
 - e. CFC - California Fire Code
 - f. CMC - California Mechanical Code
 - g. CPC - California Plumbing Code
 - h. CSFM - California State Fire Marshal
- C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
 - 1. ABA - Architectural Barriers Act
 - 2. ABMA - American Bearing Manufacturers Association
 - 3. ADA - Americans with Disabilities Act
 - 4. AHRI - Air-Conditioning Heating & Refrigeration Institute
 - 5. AMCA - Air Movement and Control Association
 - 6. ANSI - American National Standards Institute
 - 7. ASCE - American Society of Civil Engineers
 - 8. ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning Engineers
 - 9. ASHRAE Guideline 0, The Commissioning Process
 - 10. ASME - American Society of Mechanical Engineers
 - 11. ASPE - American Society of Plumbing Engineers
 - 12. ASSE - American Society of Sanitary Engineering

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13. ASTM - ASTM International
 14. AWWA - American Water Works Association
 15. CFR - Code of Federal Regulations
 16. CGA - Compressed Gas Association
 17. CISPI - Cast Iron Soil Pipe Institute
 18. EPA - Environmental Protection Agency
 19. ETL - Electrical Testing Laboratories
 20. FM - FM Global
 21. GAMA - Gas Appliance Manufacturers Association
 22. HI - Hydraulic Institute Standards
 23. IAPMO - International Association of Plumbing & Mechanical Officials
 24. IFGC - International Fuel Gas Code
 25. ISO - International Organization for Standardization
 26. MSS - Manufacturers Standardization Society
 27. NEC - National Electric Code
 28. NEMA - National Electrical Manufacturers Association
 29. NFPA - National Fire Protection Association
 30. NFCC - National Fuel Gas Code
 31. NRCA - National Roofing Contractors Association
 32. NSF - National Sanitation Foundation
 33. OSHA - Occupational Safety and Health Administration
 34. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.
 35. TEMA - Tubular Exchanger Manufacturers Association
 36. TIMA - Thermal Insulation Manufacturers Association
 37. UL - Underwriters Laboratories, Inc.
- D. See Division 23, HVAC individual Sections for additional references.

1.4 SUBMITTALS

- A. See Division 01, General Requirements for Submittal Procedures as well as specific individual Division 23, HVAC Sections.

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- B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.
- C. In addition:
1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
 2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail and be native/searchable PDF format. Scanned copies are not acceptable. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. Deviations will be returned without review.
 3. Product Data: Provide Manufacturer's descriptive literature for products specified in Division 23, HVAC Sections.
 4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.
 - a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
 - b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 23, HVAC Specification Sections for specific items required in product data submittal outside of these requirements.
 - c. Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.
 - d. For vibration isolation of equipment, list make and model selected with operating load and deflection.
 - e. See Division 23, HVAC individual Sections for additional submittal requirements outside of these requirements.

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5. Maximum of two reviews of submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of these additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer's comments. Identify Engineer's comments and provide an individual response to each of the Engineer's comments. Cloud changes in the submittals and further identify changes which are in response to Engineer's comments.
7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.
8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required by Division 23, HVAC Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.
9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
10. Substitutions and Variation from Basis of Design:
 - a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
 - b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.
11. Shop Drawings: Provide coordinated shop drawings which include physical characteristics of all systems, equipment, ductwork and piping layout plans, and control wiring diagrams. Reference individual Division 23, HVAC Specification Sections for additional requirements for shop drawings outside of these requirements.
 - a. Provide Shop Drawings indicating access panel locations for items that require Code or maintenance access, size and elevation for approval prior to installation.

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12. Samples: Provide samples when requested by individual Sections.
13. Resubmission Requirements:
 - a. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
 - 1) Resubmit for review until review indicates no exception taken or make "corrections as noted".
 - 2) When submitting drawings for Engineers re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.
14. Operation and Maintenance Manuals, Owner's Instructions:
 - a. Submit, at one time, electronic files (native/searchable PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Include valve charts. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
 - 1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
 - 2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment: belts, motors, lubricants, and filters.
 - 3) Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Sections.
 - 4) Include product certificates of warranties and guarantees.
 - 5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
 - 6) Include copy of startup and test reports specific to each piece of equipment.
 - 7) Include copy of final air and water systems balancing log along with pump, fan and distribution system operating data.
 - 8) Include commissioning reports.

- 9) Include copy of valve charts/schedules.
 - 10) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.
- b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 23 00 00, HVAC Basic Requirements Article titled "Demonstration".
 - c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.
15. Record Drawings:
- a. Maintain at site at least one set of drawings for recording "As-constructed" conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements, location of cleanouts, and location of concealed mechanical items. Include items changed by field orders, supplemental instructions, and constructed conditions.
 - b. Record Drawings are to include equipment and fixture/connection schedules, control dampers, fire smoke dampers, fire dampers, valves, bottom of pipe, duct and equipment elevations and dimensioned locations for all distribution systems (hydronic and air). Invert elevations and dimensioned locations for underground systems below grade to 5-feet outside building that accurately reflect "as constructed or installed" for project.
 - c. At completion of project, input changes to original project CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD Files and drawings upon substantial completion.
 - d. See Division 23, HVAC individual Sections for additional items to include in record drawings.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
- B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.
- C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of

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equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

- D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.
- E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
- F. Provide products that are UL listed.
- G. Piping and duct insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.
- H. ASME Compliance: ASME listed water heaters and boilers with an input of 200,000 BTUH and higher, hot water storage tanks which exceed 120 gallons, and hot water expansion tanks which are connected to ASME rated equipment or required by code or local jurisdiction.
- I. Provide safety controls required by National Boiler Code (ASME CSD 1) for boilers and water heaters with an input of 400,000 BTUH and higher.

1.6 WARRANTY

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Contracting and Procurement Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

- A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, equipment, fire sprinklers, plumbing, cable trays, lights, and electrical services with architectural and structural requirements, and other trades (including ceiling suspension, and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.
- B. Advise Architect in event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.
- C. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.

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- D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to pumps, fans, valves, control devices, air handlers, vibration isolation devices, etc.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL or ETL approved or have adequate approval or be acceptable by State, County, and City authorities.
- B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- C. Hazardous Materials:
1. Comply with local, State of California, and Federal regulations relating to hazardous materials.
 2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
 3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

- A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Install equipment having components requiring access (i.e., drain pans, drains, control operators, valves, motors and vibration isolation devices) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions including all appurtenances recommended in manufacturer's installation instructions, at no additional charge to Owner. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing and coordination with other trades and disciplines.

D. Earthwork:

1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
 - a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork Sections. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
 - b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
 - c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:

1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
 - a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Pipe Installation:

1. Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building, as well as anticipated settlement or shrinkage of building. Install work to prevent damage to piping, equipment, and building and its contents. Provide piping offsets, loops, seismic flexible joints, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building with Project Structural Engineer. Verify construction phasing, type of building construction products and rating for coordinating installation of piping systems.
2. Include provisions for servicing and removal of equipment without dismantling piping.

G. Plenums:

1. Plenums: Materials within plenums shall be noncombustible or shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E 84 or UL 723. Immediately notify Architect / Engineer of any discrepancy.

3.2 SEISMIC CONTROL

- A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, Section 23 0548, Vibration and Seismic Controls for HVAC Equipment, and

individual Division 23 HVAC Sections.

B. Piping and Ductwork:

1. Per CBC or OSHPD's OPM requirements.

C. Provide means to prohibit excessive motion of mechanical equipment during earthquake.

3.3 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:

1. Underground system installation prior to backfilling.
2. Prior to covering walls.
3. Prior to ceiling cover/installation.
4. After major equipment is installed.
5. When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Final Punch:

1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Mechanical Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the mechanical systems are ready for final punch.
2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CONTINUITY OF SERVICE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

1. During remodeling or addition to existing structures, while existing structure is occupied, current services to remain intact until new construction, facilities or equipment is installed.
2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new piping and ductwork, and wiring to point of connection. Where existing systems are being utilized, clean existing distribution systems (ductwork, piping, fans, air handlers) prior to connecting new ductwork or piping.
3. Coordinate transfer time to new service with Owner. If required, perform transfer during off peak hours. Once changeover is started, pursue to its completion to keep interference

to a minimum.

- a. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.

4. Organize work to minimize duration of power interruption.

3.5 CUTTING AND PATCHING

- A. Confirm Cutting and Patching requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.6 EQUIPMENT SELECTION AND SERVICEABILITY

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.
- B. Maintain design intent where equipment other than as shown as Basis of Design in Contract Documents is provided. Where equipment requires ductwork or piping arrangement, controls/control diagrams, or sequencing different from that indicated in Contract Documents, provide at no additional cost to Owner.

3.7 DELIVERY, STORAGE AND HANDLING

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

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1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt, and/or dust as a result of improper storage to be replaced before installation.
2. Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
3. Protect bright finished shafts, bearing housings and similar items until in service.

3.8 DEMONSTRATION

- A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.9 CLEANING

- A. Confirm Cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

- A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.
- C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements.

Replace damaged or malfunctioning controls and equipment.

1. Do not place equipment in sustained operation prior to initial balancing of HVAC systems.
- D. Provide miscellaneous supports/metals required for installation of equipment, piping and ductwork.

3.11 PAINTING

- A. Confirm Painting requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces in mechanical rooms, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
2. After acceptance by Authority Having Jurisdiction (AHJ), In a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
3. See individual equipment Specifications for other painting.
4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
5. Piping and Ductwork: Clean, primer coat and paint exposed piping and ductwork on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Architect.
6. Covers: Covers such as manholes, cleanouts and the like will be furnished with finishes which resist corrosion and rust.

3.12 ACCEPTANCE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
 - a. Testing and Balancing Reports
 - b. Cleaning
 - c. Operation and Maintenance Manuals
 - d. Training of Operating Personnel
 - e. Record Drawings

- f. Warranty and Guaranty Certificates
 - g. Start-up/Test Document
 - h. Commissioning Reports
- B. Reference State of California requirements for specific testing procedures and documentation requirements. Comply with State and local governmental standards and requirements for testing, and completion and submittal of appropriate forms as required by Title 24 and local governmental agencies related to this work.

3.13 FIELD QUALITY CONTROL

- A. Confirm Field Quality Control requirements in Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Tests:
 - 1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in Operation and Maintenance Manuals.
 - 2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.14 LETTER OF CONFORMANCE

- A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that HVAC items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

3.15 ELECTRICAL INTERLOCKS

- A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.

3.16 TEMPORARY HEATING, COOLING AND HUMIDITY CONTROL

- A. Provide temporary heating, cooling, controls, humidification and dehumidification as required to facilitate the construction of the project. Size and select temporary system based on the requirements of the various trades during construction. This includes, but is not limited to, drywall, case work, wood flooring and wood finishes that are subject to warping. Size and install system to prevent mold growth. Coordinate the location of the temporary system. The house system can be used. Develop a procedure for how the house system will be used including a sketch depicting the house system, how filtration will be used to prevent construction debris from entering the system and how often the filters will be changed, how the ductwork will be cleaned after use to ensure a clean system is turned over to the Owner and how the units are sized. Submit this procedure to the Mechanical Engineer for review. Follow National Air Duct Cleaners Association (NADCA) duct cleaning procedures and guidelines. Warranties for the house system, if new, to commence when the Owner moves in if house system is used as the

means to maintain the climate within the building during construction. Include this warranty requirement in the original bid or proposal amount. Coordinate and provide any temporary power, controls, ductwork, piping, plumbing anchorage, miscellaneous steel and structural supports required to support the temporary system. Installation of the system to comply with all applicable codes and be acceptable to the Authority Having Jurisdiction (AHJ).

END OF SECTION

SECTION 23 0513
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Starters
 - 2. Shaft Grounding
 - 3. Motors

1.2 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. NEMA Premium Efficiency
 - 2. Energy Policy Act (EPACT), latest applicable version(s) for minimum motor efficiencies.

1.4 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Starters:
 - 1. Cerus
 - 2. Eaton Electrical

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3. General Electric
 4. Siemens
 5. Schneider Electric/Square D
 6. Or approved equivalent.
- B. Shaft Grounding:
1. Shaft Grounding Inc.
 2. Aegis SGR Bearing Protection Ring
 3. Or approved equivalent.
- C. Motors:
1. Lincoln Motor
 2. Century Electric Motors (formerly A.O. Smith Electrical Products)
 3. Baldor Electric
 4. General Electric
 5. Toshiba
 6. Exception: Motors integral to equipment efficiency listing (EER, COP, etc.) per listing agency.
 7. Or approved equivalent.

2.2 STARTERS

- A. Single Phase Motors:
1. Manual across-the-line starting switch having toggle-operated switch pilot running light and built-in thermal overload device with heating element rated not more than 115 percent motor full load current indicated on name plate of motor to be protected. Surface mount starters. Provide NEMA-1 enclosure.
 2. Overload relays to be melting alloy type with a replaceable control circuit module. Thermal units to be interchangeable. Starter to be non operative if thermal unit is removed.
 3. Single-phase motors with automatic controls. Provide motor-rated relay with coils rated for control voltage.
- B. Starters up to Size 8 to be suitable for the addition of a minimum of three external auxiliary contacts (normally open or normally closed). Contactor, coils, and relays to perform the control functions of the associated equipment and control sequence.
- C. Three Phase Motors up to and Including 15 HP:

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1. Provide enclosed type magnetic across-the-line starter with thermal overload and undervoltage protection.
2. Operator: "Start-Stop" pushbutton, except where automatic control is indicated on Drawings or specified. Then provide "Hand-Off-Auto" selector switch.
3. Starters for 3-phase motors to have overload protection in each of the three legs, with external manual reset.
4. Unless indicated on Drawings or in Specifications, furnish motor starters with a neon pilot light. Neon lights are required for exhaust fan switches.
5. Equip starters with integral transformer and coil for control circuit. Coordinate coil voltage with control voltage.

2.3 SHAFT GROUNDING

- A. Variable Speed Motor Shaft Grounding: Shaft grounding ring; solid ring type.
- B. Provide shaft grounding assembly on motors controlled by variable frequency drive. Shaft grounding device to be in the form of brush that resides on the motor shaft. Brush assembly shall be capable of tolerating misalignment and maintaining rotating contact throughout the motors life.
- C. Material: Material used in the grounding assembly shall be stable material commonly used within industry that is not believed to constitute a hazardous material under Occupational Safety & Health Administration (OSHA) regulations.
- D. Brushes: Specifically developed carbon compounds of sustained performance with wear life expectancy of 3 years minimum.
- E. Seals: Sealed type to keep contaminants from entering the shaft grounding system in wet or severe environment applications.
- F. Shaft Grounding Assembly: For clean room air handling systems, use the type that contains the wear products within a special enclosure within the shaft grounding system.

2.4 MOTORS

- A. Construction:
 1. Open drip-proof type except where specifically noted otherwise.
 2. Design for continuous operation in 40 degrees C environment.
 3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
 4. Built-in thermal overload protection or externally protected with separate over-load with low-voltage release or lock-out. Quick trip device on hermetically sealed motors.
 5. Service Factor: 1.15 for poly-phase motors except 1.25 for motors associated with shaft pressurization system fans and 1.35 for single phase motors.

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6. Efficiency: Provide NEMA Premium Efficiency motors.
 7. Motors used in conjunction with variable speed drives: Variable torque type matched for the full operating range of the variable frequency drive. As a minimum, motors to have Class F insulation, winding insulation rated for 1000 Volts and insulated bearings to prevent high frequency ground path. Loads not-to-exceed 80 percent of nameplate rating
- B. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.
- C. Wiring Terminations:
1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Coordinate conductor sizes with Division 26, Electrical. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
 2. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.
- D. Single Phase Power, Split Phase Motors:
1. Starting Torque: Less than 150 percent of full load torque.
 2. Starting Current: Up to seven times full load current.
 3. Breakdown Torque: Approximately 200 percent of full load torque.
 4. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.
 5. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.
- E. Single Phase Power, Permanent-Split Capacitor Motors:
1. Starting Torque: Exceeding one fourth of full load torque.
 2. Starting Current: Up to six times full load current.
 3. Multiple Speed: Through tapped windings.
 4. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.
- F. Single Phase Power, Capacitor Start Motors:
1. Starting Torque: Three times full load torque.
 2. Starting Current: Less than five times full load current.
 3. Pull-up Torque: Up to 350 percent of full load torque.
 4. Breakdown Torque: Approximately 250 percent of full load torque.

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5. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.
6. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.
7. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

G. Three Phase Power, Squirrel Cage Motors:

1. Starting Torque: Between 1 and 1-1/2 times full load torque.
2. Starting Current: Six times full load current.
3. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.
4. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.
5. Insulation System: NEMA Class B or better. Use class F insulation when motors are controlled by a VFD.
6. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.
7. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
8. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors imbedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter.
9. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
10. Sound Power Levels: To NEMA MG 1.
11. Weatherproof Epoxy Treated Motors: Epoxy coat windings with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.
12. Nominal Efficiency: Meet or exceed NEMA Premium Efficiency rating when tested in accordance with IEEE 112.
13. Nominal Power Factor: Minimum at full load and rated voltage when tested in accordance with IEEE 112.

3.1 GENERAL INSTALLATION

- A. Coordinate location of disconnect and starter or motor controller. Combination starter/disconnects may be used in lieu of separate items.
- B. Explosion-Proof Motors: UL approved and labeled for hazard classification, with over temperature protection.
- C. Provide inverter ready motors per NEMA MG1-30 for variable speed drive or soft-start starter use. Provide shaft grounding for motors over 2 HP serving variable speed drives. Provide shaft grounding and insulated bearings on motors 25 HP and larger serving variable speed drives. Shielded cable required for power wiring from variable speed drive to motor connection.
- D. Unless otherwise indicated, motors 1-HP and larger to meet/exceed Title 24, NEMA Premium Efficiency, and latest EPACT.
- E. Vertical in-line pump motors per NEMA MG1 vertical motor requirements.
- F. Exception: Motors less than 250 watts, for intermittent service, motors furnished with equipment manufacturer's standard package equipment need not conform to these specifications.
- G. Single phase motors for air compressors and pumps: Capacitor start type.
- H. Motors located in exterior locations or wet air streams are to be of totally enclosed type.
- I. Motors located in outdoor, wet/wash-down locations: Totally enclosed weatherproof epoxy-sealed type. Provide protective covering for electronically commutated motors located in outdoor or wet/wash-down locations.
- J. Disconnects: Provided by Division 26, Electrical unless specified otherwise.
- K. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

3.2 STARTER INSTALLATION

- A. Install starters in accordance with manufacturer's instructions.
- B. Coordinate disconnect requirements and location with Division 26, Electrical if not integral to starter. If starter is installed out of line of sight of motor, provide additional disconnect at motor per code.
- C. Provide NEMA housing appropriate to installation location.
- D. Provide supports and install securely, in neat and workmanlike manner, as specified in NECA 1.
- E. Meet mounting height and accessible location requirements per local code.
- F. Provide fuses for fusible switches.
- G. Select and install overload heater elements in motor starters to match installed motor characteristics.

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- H. Single Phase 120 Volt Starter: If not furnished as single packaged controller/disconnect, provide contactors, relays, wiring and devices necessary to match sequence of operation for equipment.

3.3 SHAFT GROUNDING INSTALLATION

- A. Shaft grounding assembly installation not to affect the motor manufacturer warranty. Where the severe environment conditions require application of the shaft grounding types that are screwed into the motor shaft, the installation of the shaft grounding system performed either by the motor manufacturer or by the motor manufacturer authorized facility.
- B. Bond the brush to the closest ground point using code sized green insulated stranded copper conductor per manufacturer instructions.
- C. Test and verify the performance of the assembly to ensure that under no conditions the shaft exceeds 3 volts.
- D. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- E. Check line voltage and phase and ensure agreement with nameplate.
- F. Verify motor rotation.

3.4 MOTOR INSTALLATION

- A. Electrical Service: Power wiring from source to motor termination under Division 26, Electrical.
- B. Install in accordance with manufacturer's instructions. Coordinate with starter or variable speed controller with control sequence to provide necessary starter accessories.
- C. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- D. Check line voltage and phase and ensure agreement with nameplate.
- E. Verify motor rotation.
- F. Field Quality Control:
 1. Prepare for acceptance tests as follows:
 - a. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
 - b. Test interlocks and control features for proper operation.
 - c. Verify that current in each phase is within nameplate rating.
 2. Testing: Perform the following field quality-control testing:
 - a. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.15.1. Certify compliance with test parameters.
 - b. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

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3. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:

- a. Inspect field-assembled components, equipment installation, and piping and electrical connections for compliance with requirements.
- b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- c. Verify bearing lubrication.
- d. Verify proper motor rotation.
- e. Test Reports: Prepare a written report to record the following test procedures used:
 - 1) Test results that comply with requirements.
 - 2) Test results that do not comply with requirements and corrective action taken to achieve compliance.

G. Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

H. Clean motors, on completion of installation, according to manufacturer's written instructions.

END OF SECTION

SECTION 23 0529

HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Hangers and Supports for HVAC Piping, Ductwork and Equipment
2. Wall and Floor Sleeves
3. Building Attachments
4. Flashing
5. Miscellaneous Metal and Materials

1.2 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. ASCE 7-16, Minimum Design Loads for Buildings and Other Structures.
2. Terminology: As defined in MSS SP-90 "Guidelines on Terminology for Pipe Hangers and Supports".
3. Install ductwork and piping per SMACNA's requirements.
4. Hanger spacing installation and attachment to meet all manufacturer's requirements and MSS SP-58.

1.4 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Welding:

- a. Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications".
- 2. Welding for Hangers:
 - a. Qualify procedures and personnel according to AWS D9.1, Sheet Metal Welding Code for duct joint and seam welding.
- 3. Engineering Responsibility:
 - a. Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, duct support equipment hangers/supports, support from floor structure, roof structure or from structure above, and seismic restraint by a qualified Structural Professional Engineer.
 - 1) Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.
- 4. Manufacturers regularly engaged in the manufacture of bolted metal framing support systems, whose products have been in satisfactory use in similar service for not less than 10 years.
- 5. Support systems to be supplied by a single manufacturer.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 PERFORMANCE REQUIREMENTS

- A. Provide pipe, ductwork and equipment hangers and supports in accordance with the following:
 - 1. When supports, anchorages, and seismic restraints for equipment, and supports, anchorages, and seismic restraints for conduit, piping, and ductwork are not shown on the Drawings, the contractor is responsible for their design.
 - 2. Connections to structural framing not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- B. Engineered Support Systems:
 - 1. Support frames such as pipe racks or stanchions for piping, ductwork, and equipment which provide support from below.
 - 2. Equipment, ductwork and piping support frame anchorage to supporting slab or structure.
- C. Provide channel support systems, for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

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- D. Provide heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- E. Provide seismic restraint hangers and supports for piping, ductwork and equipment. See Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment.
- F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment. See Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Hangers and Supports for HVAC Piping, Ductwork and Equipment:

1. Anvil International
2. B-Line Systems, Incorporated
3. Erico Company, Incorporated
4. Nelson-Olsen Incorporated
5. Rilco Manufacturing Company, Incorporated
6. Snappitz Thermal Pipe Shield Manufacturing
7. Unistrut Corporation

- B. Wall and Floor Sleeves:

1. Thunderline Corporation "Link Seal".
2. Or approved equivalent.

- C. Building Attachments:

1. Anchor-It
2. Gunnebo Fastening Corporation
3. Hilti Corporation
4. ITW Ramset/Red Head
5. Masterset Fastening Systems, Incorporated

2.2 HANGERS AND SUPPORTS for HVAC Piping, Ductwork and Equipment

- A. Hanger Rods: Hanger rods continuously threaded or threaded ends only in concealed spaces and threaded ends only in exposed spaces; finish electro-galvanized or cadmium-plated in concealed spaces and prime painted in exposed spaces; sizes per MSS.

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- B. Hanger Rod Couplings: Anvil Figure 136, B-Line Figure B3220, or approved equivalent; malleable iron rod coupling with elongated center sight gap for visual inspection; to have same finish as hanger rods.
- C. Channel Hanging System:
1. Framing members No. 12 gauge formed steel channels, 1-5/8-inch square, conforming to ASTM A1011 Grade 33, one side of channel to have a continuous slot within turned lips; framing nut with grooves and spring 1/2-inch size, conforming to ASTM 675 GR60; screws conforming to ASTM A307; fittings conforming to ASTM A575; parts enamel painted or electro-galvanized.
 2. Concrete Inserts: Malleable iron body, hot dipped galvanized finish. Lateral adjustment. MSS Type 18.
- D. Continuous Concrete Insert: Steel construction, minimum 12 gauge. Electrogalvanized finish. Pipe clamps and insert nuts to match.
- E. Pipe Hangers:
1. Pipe Rings for Hanger Rods:
 - a. Pipe Sizes 2-inches and Smaller: Adjustable swivel ring hanger, UL listed. Erico 100 or 101, Anvil Figures 69 or 104, or approved equivalent.
- F. Pipe Saddles and Shields:
1. Factory fabricated saddles or shields under piping hangers and supports for insulated piping.
 2. Size saddles and shields for exact fit to mate with pipe insulation. 1/2 round, 18 gauge, minimum 12-inches in length (4-inch pipe and larger to be three times longer than pipe diameter).
- G. Riser Clamps: Steel, UL listed. MSS Type 8. Erico 510 or 511. Copper coated; Erico 368.
- H. Pipe Slides: Anvil, reinforced Teflon slide material (3/32-inch minimum thickness) bonded to steel; highly finished steel or stainless steel contact surfaces to resists corrosion; 60-80 PSI maximum active contact surface loading; steel parts 3/16-inch minimum thickness; attachment to pipe and framing by welding.
- I. Pipe Guides:
1. Furnish and install pipe guides on continuous runs where pipe alignment must be maintained. Minimum two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides securely to pipe and structure. Contact with chilled water pipe not to permit heat to be transferred in sufficient quantity to cause condensation on any surface.
 2. Furnish and install guides approximately four pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Guides are not to be used as supports and are in addition to other pipe hangers and supports.

J. Thermal Hanger Shield Inserts:

1. 100-PSI (690-kPa) minimum compressive strength calcium silicate insulation, encased in sheet metal shield or polyisocyanurate rigid foam exceeding the load bearing weight of the pipe at the hanger point with a PVC vapor barrier.
2. Material for Cold Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with vapor barrier or polyisocyanurate rigid foam with a PVC vapor barrier.
3. Material for Hot Piping: Water-repellent-treated ASTM C533, Type 1 calcium silicate or polyisocyanurate rigid foam with a PVC vapor barrier.
4. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
5. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
6. Insert Length: Extend 2-inches beyond sheet metal shield for piping operating below ambient air temperature.
7. Thermal Hanger Shield Insulation Operating Temperature: Meet or exceed fluid temperature in pipe.

2.3 WALL AND FLOOR SLEEVES

A. Below Grade or High Water Table Areas:

1. "Link-Seal" Pipe Sleeves: Neoprene gasket links bolted together around an interior sleeve forming a watertight seal.
2. Provide Type S unless otherwise noted.

B. Pre-Engineered Firestop Pipe Penetration Systems: UL listed assemblies for maintaining fire rating of piping penetrations through fire-rated assemblies. Comply with ASTM E814.

C. Fabricated Accessories:

1. Steel Pipe Sleeves: Fabricate from Schedule 40 black or galvanized steel pipe. Remove end burrs by grinding.
2. Sheet Metal Pipe Sleeves: Fabricate from G-90 galvanized sheets closed with lock-seam joints. Provide the following minimum gauges for the sizes indicated:
 - a. Sleeve Size 4-inches in Diameter and Smaller: 18 gauge.
 - b. Sleeve Sizes 5-6-inches: 16 gauge.
 - c. Sleeve Sizes 7-inches and Larger: 14 gauge.
 - d. Fire-Rated Safing Material.
 - 1) Rockwool Insulation: Complying with FS-HH-I-558, Form A, Class IV, 6 pounds per cubic foot density with melting point of 1985 degrees F and K value of 0.24 at 75 degrees F.

- 2) Calcium Silicate Insulation: Noncombustible, complying with FS-HH-I-523, Type II, suitable for 100 degrees F to 1200 degrees F service with K value of 0.40 at 150 degrees F.

2.4 BUILDING ATTACHMENTS

- A. Beam Clamps:
 - 1. MSS Type 19 and 23, wide throat, with retaining clip.
 - 2. Universal Side Beam Clamp: MSS Type 20.
- B. Powder-Actuated Drive Pin Fasteners: Powder actuated type, drive pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- C. Anchor Bolts:
 - 1. Anchor supports to existing masonry, block and tile walls per anchoring system manufacturer's recommendations or as modified by project structural engineer. Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
 - 2. Anchor Bolts (Cast-In-Place): Steel bolts, ASTM A307. Nuts to conform to ASTM A194. Design values for shear and tension not more than 80 percent of the allowable listed loads.
 - 3. Anchor (Expansion) Bolts: Carbon steel to ASTM A307; nut to conform to ASTM A194; drilled-in type. Design values for shear and tension not more than 80 percent of the allowable listed loads.
 - 4. Anchor (Adhesive) Bolts: Consisting of two-part adhesive cartridge and zinc-plated Type A307 steel anchor bolt rod assembly with ASTM A194 nut.

2.5 FLASHING

- A. Steel Flashing: 26 gauge galvanized steel.
- B. Safes: 8 mil thick neoprene.
- C. Caps: Steel, 22 gauge minimum, 16 gauge at fire-resistant structures.

2.6 MISCELLANEOUS METAL AND MATERIALS

- A. General:
 - 1. Provide miscellaneous supports and metal items, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on drawings or otherwise not shown on drawings that are necessary for completion of the project. Contractor is responsible for their design.
 - 2. Fabricate miscellaneous units to size shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to

receive hardware and similar items.

- B. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.
- C. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.
- D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.
- E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.
- F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.
- G. Provide hot dipped galvanized components for items exposed to weather. Cold galvanize field-welded joints and components. Use materials compatible with system being supported (i.e. aluminum for aluminum ductwork, stainless steel for stainless steel ductwork).
- H. Use straps, threshold rods and wire with sizes required by SMACNA to support ductwork.
- I. Grout:
 - 1. ASTM C1107, Grade B, factory mixed and packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
 - 2. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
 - 3. Properties: Nonstaining, noncorrosive, and non gaseous.
 - 4. Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REquirements

- A. Verify building materials to have hangers and attachments affixed in accordance with hangers to be used. Provide supporting calculations.
- B. Examine Drawings and coordinate for verification of exact locations of fire and smoke rated walls, partitions, floors and other assemblies. Indicate, by shading and labeling on Record Drawings such locations and label as "1-Hour Wall", "2-Hour Fire/Smoke Barrier", and the like. Determine proper locations for piping penetrations. Set sleeves in place in new floors, walls or roofs prior to concrete pour or grouting.
- C. Install hangers, supports, anchors and sleeves after required building structural work has been completed in areas where the work is to be installed. Coordinate proper placement of inserts, anchors and other building structural attachments.

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- D. Equipment Clearances: Do not route ductwork, equipment, or piping through electrical rooms or other electrical or electronic equipment spaces and enclosures and the like. Within equipment rooms, provide minimum 3-feet lateral clearance from all sides of electric switchgear panels. Do not route ductwork, equipment, or piping above any electric power or lighting panel, switchgear, or similar electric device. Coordinate with Electrical and coordinate exact ductwork, equipment or pipe routing to provide proper clearance with such items.

3.2 HANGERS AND SUPPORTS for HVAC Piping, Ductwork and Equipment

- A. Hang rectangular sheet-metal ducts with a cross sectional area of less than 7 SF with galvanized strips of No. 16 USS gauge steel 1-inch wide, and larger ducts with steel angles and adjustable hanger rods similar to piping hangers. Support at a maximum of 8-feet on center.
- B. Support horizontal ducts within 24-inches of each elbow and within 48-inches of each branch intersection.
- C. Design hangers and supports to allow for expansion and contraction.
- D. Provide aluminum supports for aluminum ductwork.
- E. Provide stainless steel supports for stainless steel ductwork.
- F. Support vertical ducts at maximum intervals of 16-feet and at each floor.
- G. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- H. Install flexible ductwork per the more stringent of SMACNA HVAC Duct Construction Standards or the following:
 - 1. Support horizontal duct runs at not more than 4 feet intervals.
 - 2. Support vertical risers at not more than 6 feet intervals.
 - 3. Limit sag between support hangers to 1/2-inch per foot of spacing support.
 - 4. Supports shall be rigid and shall be not less than 1.5-inches wide at point of contact with the duct surface.
 - 5. Duct bends shall be not less than 1.5 duct diameter bend radius.
- I. Use double nuts and lock washers on threaded rod supports.
- J. Floor supports in mechanical rooms to be elevated 1-inch above finish floor and void space filled with masonry grout.
- K. Anchor ducts securely to building in such a manner as to prevent transmission of vibration to structure. Do not connect duct hanger straps directly to roof deck. Do not support ducts from other ducts, piping or equipment.
- L. Attach strap hangers installed flush with end of sheet-metal duct run to duct with sheet-metal screws.

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- M. Construct exterior ductwork or ductwork which is otherwise exposed to weather watertight and slope 1/4-inch per foot to avoid standing water.
- N. Exposed ductwork hung in clean areas such as sanitary areas, pharmaceutical areas, wash down areas or food process areas to be installed using double end, food grade trapeze hanger rods suitable for use with food grade strut.
- O. Channel Support System Installation:
 - 1. Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
 - 2. Field assemble and install according to manufacturer's written instructions.
- P. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- Q. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- R. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- S. Adjust hangers so as to distribute loads equally on attachments. Provide grout under supports to bring piping, ductwork and equipment to proper level and elevations.
- T. Prime paint ferrous nongalvanized hangers, accessories, and supplementary steel which are not factory painted.
- U. Horizontal Piping Hangers and Supports; Horizontal and Vertical Piping, and Hanger Rod Attachments:
 - 1. Factory fabricated horizontal piping hangers and supports complying with MSS SP-58, to suit piping systems and in accordance with manufacturer's published product information.
 - 2. Use only one type by one manufacturer for each piping service.
 - 3. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping.
 - 4. Pipe support spacing (pipe supported in ceiling or floor-supported) to meet latest applicable Code and manufacturer's requirements.
 - 5. Provide copper-plated hangers and supports for uninsulated copper piping systems.
- V. Plumber's Tape not permitted as pipe hangers or pipe straps.
- W. Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. For horizontally hung grooved-end piping, provide a minimum of 2 hangers per pipe section.
- X. Pipe Ring Diameters:

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1. Uninsulated and Insulated Pipe, Except Where Oversized Pipe Rings are Specified: Ring inner diameter to suit pipe outer diameter.
 2. Insulated Piping Where Oversized Pipe Rings are Specified and Vibration Isolating Sleeves: Ring inner diameter to suit outer diameter of insulation or sleeve.
- Y. Pipe Support Brackets: Support pipe with pipe slides.
- Z. Steel Backing in Walls: Provide steel backing in walls to support fixtures and piping hung from steel stud walls.
- AA. Group parallel runs of horizontal piping to be supported together on trapeze-type hangers. Maximum spacings: MSS SP-58.
- BB. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe.
- CC. Do not support piping from other piping.
- DD. Fire protection piping will be supported independently of other piping.
- EE. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated.
- FF. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping" is not exceeded.
- GG. Insulated Piping:
1. Attach clamps and spacers to piping.
 - a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating Below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 2. Do not exceed pipe stress limits according to ASME B31.9.
 3. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 4. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields to span arc of 180 degrees.
 5. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
 6. Shield Dimensions for Pipe, not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN8 to DN 90): 12-inches long and 0.048-inch thick.
- HH. Pipe Anchors: Provide anchors to fasten piping which is subject to expansion and contraction, and adjacent to equipment to prevent loading high forces onto the equipment.

II. Pipe Curb Assemblies:

1. Provide prefabricated units for roof membrane and insulation penetrations related to equipment. Coordinate with roofing system. Set supports on the structural deck. Do not set supports on insulation or roofing. Provide level supports by prefabricated pitch built into the curb.
 2. Provide for piping and electrical conduit which penetrates the structural roof deck to service equipment above the roof level (i.e., piping, electrical power and control wiring). Meet requirements of roof warranty.
- JJ. Escutcheon Plates: Install around horizontal and vertical piping at visible penetrations through walls, partitions, floors, or ceilings, including penetrations through closets, through below ceiling corridor walls, and through equipment room walls and floors.

KK. Vertical Piping:

1. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved.
2. Riser clamps to be directly under fitting or welded to pipe.
 - a. Riser to be supported at each floor of penetration.
 - b. Provide structural steel supports at the base of pipe risers. Size supports to carry forces exerted by piping system when in operation.

3.3 WALL AND FLOOR SLEEVES

- A. "Link-Seal" Pipe Sleeves: Install at floor/below grade piping penetrations. Provide manufacturer's sleeve appropriate to seal type for pre-cast penetrations.
- B. Fabricated Pipe Sleeves:
1. Provide either steel or sheet metal pipe sleeves accurately centered around pipe routes. Size such that piping and insulation, if any, will have free movement within the sleeve, including allowance for thermal expansion. Sleeve diameter to be determined by local seismic clearance requirements, and by waterproofing requirements.
 2. Length: Equal to thickness of construction penetrated, except extend floor sleeves 1-inch above floor finish.
 3. Provide temporary support of sleeves during placement in concrete and other work around sleeves. Provide temporary end closures to prevent concrete and other materials from entering pipe sleeves.
 4. Seal each end airtight with a resilient nonhardening sealer, UL listed, fire rated ASTM 814.
- C. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:
1. Install fabricated pipe sleeve.

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2. After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve identification with specified material.
 3. Seal each end airtight with a resilient nonhardening UL listed fire resistant ASTM 814.
- D. Piping Penetrations Through Fire-Rated (One to Three Hour) Assemblies:
1. Select and install pre-engineered pipe penetration system in accordance with the UL listing and manufacturer's recommendation.
 2. Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814.
- 3.4 BUILDING ATTACHMENTS
- A. Factory fabricated attachments complying with MSS SP-58, selected to suit building substructure conditions and in accordance manufacturer's published product information.
 - B. Select size of building attachments to suit hanger rods.
 - C. Space attachments within maximum piping span length indicated in MSS SP-58.
 - D. Install building attachments within concrete slabs or attach to structural steel or wood. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping.
 - E. Attachment to Wood Structure: Anvil side beam bracket Figure 202 for attachment to wooden beam or approved attachment for a wood structure.
 - F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
 - G. Install concrete inserts before concrete is placed; fasten inserts to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top in inserts.
 - H. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Test powder-actuated insert attachments with a minimum load of 100 pounds.
 - I. Do not use powder-actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4-inches thick.
 - J. Bolting: Provide bored, drilled or reamed holes for bolting to miscellaneous structural metals, frames or for mounts or supports. Flame cut, punched or hand sawn holes will not be accepted.
 - K. Anchor Bolts:
 1. Install anchor bolts for mechanical equipment, piping and ductwork as required. Tightly fit and clamp base-supported equipment anchor bolts at equipment support points. Provide locknuts where equipment, piping and ductwork are hung.

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2. Anchor Bolts (Cast-In-Place): Embed anchor bolts in new cast-in-place concrete to anchor equipment. Install a pipe sleeve around the anchor bolt for adjustment of the top 1/3 of the bolt embedment; sizes and patterns to suit the installation conditions of the equipment to be anchored.

3.5 FLASHING

- A. Flash and counterflash where piping, ductwork and equipment passes through weather or waterproofed walls, floors, and roofs.
- B. Provide 12-inch minimum height curbs for roof-mounted mechanical equipment. Flash and counter flash with galvanized steel, soldered and waterproofed.

3.6 MISCELLANEOUS METAL AND MATERIALS

- A. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates, and similar devices. Hot dipped galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.
- B. Finishes:
 1. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with 1 coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas in primer with same material, before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.
 2. Metal in Contact with Concrete, Masonry and Other Dissimilar Materials: Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.
 3. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.
- C. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

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- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required. Avoid cutting concrete reinforcing when drilling for inserts. Reference structural drawings and reinforcing shop drawings and determine locations of stirrups prior to drilling into concrete.
- E. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items, which are to be built into concrete masonry or similar construction.
- F. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.
- G. Setting Loose Plates: Clean concrete and masonry bearing surfaces of any bond reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
- H. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut-off flush with edge of the bearing plate before packing with grout. Use metallic non-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink grout in exposed locations, unless otherwise indicated.
- I. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
- J. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.
- K. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.
- L. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.
- M. Provide galvanized components for items exposed to weather.

3.7 FIRE RATED SUPPORTS

- A. Provide fire rated support as required by Codes.

END OF SECTION

SECTION 23 0548
VIBRATION AND SEISMIC CONTROLS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Vibration Isolation
 - 2. Seismic Restraint Devices
 - 3. Factory Finishes
 - 4. Seismic-Bracing/Restraint Devices/Systems for Equipment, Piping and Ductwork
- B. General:
 - 1. Vibration isolation for mechanical ductwork, piping and equipment.
 - 2. Seismic restraint for mechanical ductwork, piping and equipment.
 - 3. Seismic Certification for equipment, hangers and systems.
 - 4. Special inspections for systems.
- C. Scope of Work:
 - 1. Vibration isolation and seismic restraint of new equipment and systems within project boundary defined in architectural drawings.
 - 2. Vibration isolation and seismic restraint of new equipment and systems in existing buildings to points of connection with existing systems.
 - 3. Seismic restraint of existing systems and equipment shown on Drawings, within project boundary defined in architectural drawings.
 - 4. Provide supplementary structural steel for seismic restraint systems. No hanging from roof deck is permitted on this project, unless specifically allowed by Structural Engineer of Record in writing prior to bid.

1.2 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Vibration Isolation:
 - a. Product Data: Provide catalog data indicating size, type, load and deflection of each isolator; and percent of vibration transmitted based on lowest disturbing frequency of equipment.
 - b. Shop Drawings: Showing complete details of construction for steel and concrete bases including:
 - 1) Fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment and cantilever loads.
 - 2) Equipment mounting holes.
 - 3) Dimensions.
 - 4) Size and location of concrete and steel bases and curbs.
 - 5) Isolation selected for each support point.
 - 6) Details of mounting brackets for isolator.
 - 7) Weight distribution for each isolator.
 - 8) Details of seismic snubbers.
 - 9) Code number assigned to each isolator.
 - c. Design calculations: Provide calculations for selecting vibration isolators and for designing vibration isolation bases.
2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
3. Seismic Restraint:
 - a. Shop Drawings: Show compliance with requirements of Quality Assurance article of this Section. Shop drawings to be stamped by a professional Structural Engineer licensed in State of California.
 - b. Calculations: Submit seismic calculations indicating restraint loadings resulting from design seismic forces. Include anchorage details and indicate quantity, diameter and depth of penetration of anchors. Calculations certified by professional Structural Engineer licensed in State of California.
4. Seismic Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter and depth of penetration of anchors.

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5. Submittals for Interlocking Snubbers: Include load deflection curves up to 1/2-inch deflection in x, y and z planes.
6. Welding certificates.
7. Equipment Certification: Provide seismic certification for equipment as noted in Seismic Design Summary or schedules on Drawings.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 1. Vibration Isolation:
 - a. Except for packaged equipment with integral isolators, single manufacturer selects and furnishes isolation required.
 - b. Deflections indicated on drawings are minimum actual static deflections for specific equipment supported.
 - c. Isolator Stability:
 - 1) Size springs of sufficient diameter to maintain stability of equipment being supported. Spring diameters not less than 0.8 of compressed height at rated load.
 - 2) Springs have minimum additional travel to solid equal to 50 percent of rated deflection.
 - 3) Springs support 200 percent of rated load, fully compressed, without deformation or failure.
 - d. Maximum Allowable Vibration Levels: Peak vibration velocities not exceed 0.08 in/sec. Correct equipment operating at vibration velocities that exceed this criteria.
 2. Seismic Restraint:
 - a. Code and Standard Requirements:
 - 1) Seismic restraint of equipment, piping and ductwork to be in accordance with latest enacted version of CBC Chapter 16.
 - b. Confirm Seismic Control requirements in Division 01, General Requirements and Structural documents.
 - c. Certification: See Seismic Design Table or schedules on Drawings for equipment, systems and seismic-restraint devices designated to have seismic certification/qualification. Horizontal and vertical load testing and analysis performed according to ASCE 7-16. Anchorage systems to bear anchorage preapproval number from an agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing

or calculations, if preapproved ratings are not available. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be sealed by qualified licensed professional engineer in State of California. Testing and calculations must include both shear and tensile loads and one test or analysis at 45 degrees to weakest mode.

- d. Seismic restraint and anchorage of permanent equipment and associated systems listed below to building structure be designed to resist total design seismic force prescribed in local building code:
 - 1) Floor- or roof-mounted equipment weighing 400 pounds or greater.
 - 2) Suspended, wall-mounted or vibration isolated equipment weighing 20 pounds or greater.
 - 3) In-line duct devices connected to ductwork weighing 75 pounds or greater.
 - 4) Housekeeping slabs: provide reinforcement and anchorage to building structure.
 - e. Where required, seismic sway bracing of suspended duct and piping meet following:
 - 1) Pipe and duct runs requiring seismic bracing have minimum of two traverse braces and one longitudinal brace. Longitudinal (or traverse) brace at 90 degree change in direction may act as traverse (or longitudinal) brace if located within 2-feet of change in direction.
 - 2) Seismic bracing may not pass through seismic separation joint. Pipe or duct runs that pass through seismic separation joint must be restrained within 5-feet of both sides of separation.
 - 3) Seismic brace assembly spacing not to exceed 40-feet transverse and 80-feet longitudinal.
 - f. Seismic restraints may be omitted from suspended piping and duct if following conditions are satisfied:
 - 1) For piping or ducts supported by rod hangers 12-inches or less in length from top of duct to bottom of structural support. Top connections to structure have swivel joints, eye bolts, or vibration isolation hangers for entire length of system run.
 - 2) Lateral motion of system will not cause damaging impact with surrounding systems or cause loss of system vertical support.
 - 3) System must be welded steel pipe, brazed copper pipe, sheet metal duct or similar ductile material with ductile connections.
- C. Seismic restraints, including anchors to building structure, be designed by registered professional Structural Engineer licensed in State of California. Design includes:

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1. Number, size, capacity and location of anchors for floor- or roof-mounted equipment. For curb-mounted equipment, provide design of attachment of both unit to curb and curb to structure.
2. Number, size, capacity and location of seismic restraint devices and anchors for vibration-isolation and suspended equipment. Provide calculations and test data verifying horizontal and vertical ratings of seismic restraint devices.
3. Number, size, capacity and location of braces and anchors for suspended piping and ductwork on as-built plan drawings.
4. Maximum seismic loads to be indicated on drawings at each brace location. Drawings bear stamp and signature of registered professional Structural Engineer who designed layout of braces.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Seismic Snubber Units: Furnish replacement neoprene inserts for snubbers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Vibration Isolation:
 1. The VMC Group
 2. B-Line Systems, Inc.
 3. Kinetics Noise Control, Inc.
 4. Mason Industries, Inc.
 5. M.W. Saussé - Vibrex
 6. Where Mason numbers are specified, equivalent products by listed manufacturers are acceptable.
- B. Seismic Restriction Devices:
 1. B-Line Systems, Inc.
 2. Kinetics Noise Control, Inc.
 3. Mason Industries, Inc.
 4. M.W. Saussé - Vibrex

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5. Cooper B-Line Tolco
 6. Unistrut Diversified Products Co.; Wayne Manufacturing Division.
 7. Hilti, Inc.
- C. Factory Finishes:
1. Kynar 500 Fluoropolymer Coating
- D. Seismic-Bracing/Restraint Devices/Systems for Equipment, Piping and Ductwork:
1. Kinetics Noise Control, Inc.
 2. Mason Industries, Inc.
 3. Hilti, Inc.
 4. Cooper B-Line, Inc.
 5. Unistrut
 6. ISAT, Inc.
 7. Where Mason numbers are specified, equivalent products by listed manufacturers are acceptable.

2.2 VIBRATION ISOLATION

- A. Type 3 - Spring: Freestanding, laterally stable, open-spring isolators.
1. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.
 2. Minimum Additional Travel: 50 percent of required deflection at rated load.
 3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, natural rubber or bridge bearing neoprene isolator pad attached to baseplate underside.
Baseplates limit floor load to 100 PSIG (690 kPa).
 6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
 7. Brackets: Manufacturer's standard bracket, utilize height saving brackets to accommodate height restrictions.
 8. Mason Type: SLFH or SLF.
- B. Type 4a - Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

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1. Housing: Steel with resilient vertical-limit stops (out of contact during normal operation) to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch thick, natural rubber or bridge bearing neoprene isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation. Restraining bolts have large rubber grommets to provide cushioning in vertical and horizontal directions. A minimum clearance of 3/8-inch maintained around restraining bolts so as not to interfere with spring action.
 2. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.
 3. Minimum Additional Travel: 50 percent of required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Brackets: Manufacturer's standard bracket, utilize height saving brackets to accommodate height restrictions.
 7. Mason Type: SLR.
- C. Type 4b - Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.
1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint with neoprene acoustical cup, spring inspection ports and rebound adjustment ports.
 2. Base: Factory drilled for bolting to structure.
 3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel before contacting a resilient collar.
 4. Brackets: Manufacturer's standard bracket, utilize height saving brackets to accommodate height restrictions.
 5. Mason Type: SSLFH.
- D. Type 5b - Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 15 degrees of angular hanger-rod misalignment from vertical without binding or reducing isolation efficiency.
 2. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.
 3. Minimum Additional Travel: 50 percent of required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

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5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 7. Mason Type: 30N.
- E. Type 5c - Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.
1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 15 degrees of angular hanger-rod misalignment from vertical without binding or reducing isolation efficiency.
 2. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.
 3. Minimum Additional Travel: 50 percent of required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 8. Mason Type: RW30.
- F. Type FC-1, Flexible duct connectors. See Specification Section 23 33 00 Air Duct Accessories.
- ### 2.3 SEISMIC RESTRAINT DEVICES
- A. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5, with a flat washer face.
- B. Seismic Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts and replaceable resilient isolation washers and bushings. Snubber load rating to match equipment size. Mason Type: Z-1011 or Z-1225.
1. Anchor bolts for attaching to concrete be seismic-rated, drill-in and stud-wedge or female-wedge type.
 2. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5.
- C. Restraining Cables: Galvanized steel aircraft cables with end connections made of steel assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement. Mason Type: SCB.

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- D. Anchor Bolts: Seismic-rated, drill-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.

2.4 FACTORY FINISHES

- A. Provide manufacturer's standard prime-coat finish ready for field painting. Units mounted outdoors exposed to weather: Epoxy powder coated, with 1000 hour salt spray rating per ASTM B-117. For high levels of corrosion protection utilize:
1. Conform to AAMA 605.2.
 2. Apply coating following cleaning and pretreatment.
 3. Cleaning: AA-C12C42R1X.
 4. Dry system before final finish application.
 5. Total Dry Film Thickness: Approximately 1.2 mils, when baked at 450 degrees F for 10 minutes.
- B. Finish:
1. Manufacturer's standard paint applied to factory-assembled and factory-tested equipment before shipping.
 2. Powder coating on springs and housings.
 3. Hardware be electrogalvanized. Hot-dip galvanize metal components for exterior use.
 4. Baked enamel for metal components on isolators for interior use.
 5. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

2.5 SEISMIC-BRACING/RESTRAINT DEVICES/SYSTEMS FOR EQUIPMENT, PIPING and DUCTWORK

- A. General Requirements for Restraint Components: Rated strengths, features and applications to be as defined in reports by agency acceptable to authorities having jurisdiction.
- B. Structural Safety Factor: Allowable strength in tension, shear and pullout force of components be at least four times maximum seismic forces to which they will be subjected.
- C. Anchor bolts for attaching to concrete to be seismic-rated, drill-in and stud-wedge or female-wedge type.
- D. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
- E. Maximum 1/4-inch air gap and minimum 1/4-inch thick resilient cushion.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Set floor-mounted equipment with steel base rails on minimum 4-inch-high concrete housekeeping pads. Extend pad minimum 6-inches beyond footprint of equipment in each direction, but not less than twice the embedment depth of concrete anchors.
- B. Provide mounts for equipment installed outdoors for wind loads of 30 lbs. psf applied to any exposed surface of isolated equipment.
- C. Do not install equipment or pipe which makes rigid contact with building slabs, beams, studs, walls, etc.
- D. Anchor baseplate to floor or structure. Provide rubber grommets and washers to isolate bolt from base plate. Under no circumstances is isolation efficiency to be destroyed when bolting isolators to floor.
- E. Building Penetrations: Isolate water piping and ductwork penetrating wall, ceilings, floors or shafts from structure by piping isolator or by 3/8-inch thick foamed rubber insulation. Install units flush with finished structure face, using one for each side as required. Cut units to length if longer than structure thickness. Caulk around pipe or duct at equipment room wall.
- F. Provide roof curbs, equipment supports and roof penetrations. Work to maintain roof warranty. Coordinate location, size, structural connections/requirements and flashing prior to installation.
- G. Vibration isolators must not cause change of position of equipment or piping which would stress piping connections or misalignment shafts or bearings. Isolated equipment is to be level and in proper alignment with connecting ducts and pipes.
- H. Pipe Hangers in Equipment Rooms: Support water and gas piping connected to rotating equipment within equipment rooms on spring and neoprene hangers. The first three hangers from a piece of vibrating equipment are to have a minimum of 1/2 static deflection of equipment isolators. Other isolators should have a minimum of 1/4 static deflection of equipment isolators.
- I. Examination:
 1. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements, installation tolerances and other conditions affecting performance.
 2. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.
- J. Testing: Perform following field quality-control testing:
 1. Isolator seismic-restraint clearance.
 2. Isolator deflection.
 3. Snubber minimum clearances.

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K. Adjusting:

1. Adjust snubbers according to manufacturer's written recommendations.
 2. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.
- L. Cleaning: After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt and debris.
- M. Demonstration: Engage factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain air-mounting systems. Reference Division 01, General Requirements.

3.2 Vibration Isolation

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Vibration isolators must be installed in strict accordance with manufacturer's written instructions and certified submittal data.
- D. Install isolation as indicated on drawings by type and location and where indicated below.
- E. Equipment Vibration Isolation Schedule:

Equipment	Size	Vibration Isolator Type	Minimum Deflection (in)
Axial	0 to 23.5-inch diameter	Type 3, 4A, 4B, 5B, or 5C, FC-1	0.75

3.3 Seismic Restraint Devices

- A. Reference 3.01, General Installation Requirements.
- B. Install in strict accordance with manufacturer's written instructions and certified submittal data.
- C. Install and adjust seismic restraints so equipment, piping and ductwork supports are not degraded by restraints.
- D. Restraints must not short circuit vibration isolation systems or transmit objectionable vibration or noise.
- E. Install restraining cables at each trapeze, individual pipe hanger and hanging vibration isolated equipment. Provide restraining cables in each of the four directions of movement. Install restraining cables no less than 45 Degrees from vertical. At trapeze anchor locations, shackle piping to trapeze. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.

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- F. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.

3.4 Factory Finishes

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Finishes to be factory-applied. No field patching or holidays allowed.

3.5 Seismic-Bracing/Restraint Devices/Systems for Equipment, Piping and Ductwork

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 23 0553
IDENTIFICATION FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Plastic Nameplates
 - 2. Tags
 - 3. Plastic Pipe Markers
 - 4. Ceiling Tags

1.2 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Schedules:
 - a. Submit valve schedule for each piping system, in tabular format using Microsoft Word or Excel software. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shutoff and similar special uses by special "flags" in margin of schedule. In addition to mounted copies, furnish extra copies for maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.
 - 2. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.

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1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01 General Requirements.

- B. In addition, provide:

1. Submit schedule of identification type, including material, for each class of tagged item.
2. Submit locations at which Valve Schedules will be installed.

PART 2 - PRODUCTS

2.1 PLASTIC NAMEPLATES

- A. Manufacturers:

1. Brady Corporation
2. Brimar
3. Champion America
4. Craftmark
5. Seton

- B. Description: Engraving stock melamine plastic laminate in the size and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color), punched for mechanical fastening except where adhesive mounting is necessary because of substrate. Provide 1/8-inch thick material.

1. Letter Color: White.
2. Letter Height: 1/2-inch.
3. Background Color: Black.
4. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
5. Access Panel Markers: Manufacturer's standard 1/16-inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve or devices/equipment. Include center hole to allow attachment.

2.2 TAGS

- A. Manufacturers:

1. Brady Corporation

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2. Brimar
 3. Champion America
 4. Craftmark
 5. Seton
- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 2-inch diameter.
- C. Metal Tags: Polished Brass with stamped letters; tag size minimum 2-inch diameter with smooth edges.
- D. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
1. Size: Approximately 4 by 7-inches.
 2. Fasteners: Brass grommet and wire.
 3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
 4. Color: Yellow background with black lettering.
- 2.3 PLASTIC PIPE MARKERS
- A. Manufacturers:
1. Brady Corporation
 2. Brimar
 3. Champion America
 4. Craftmark
 5. Seton
- B. Color: Conform to ASME A13.1 and ANSI Z535.1.
- C. Plastic Pipe Markers (for external diameters of 6-inches and larger including insulation): 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 (for external diameters less than 6-inches including insulation): Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Minimum information indicating flow direction arrow and identification of fluid being conveyed.
- E. Lettering:
1. 3/4-inch to 1-1/4-inch Outside Diameter of Insulation or Pipe: 8-inch long color field, 1/2-inch high letters.

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2. 1-1/2-inch to 2-inch Outside Diameter of Insulation or Pipe: 8-inch long color field, 3/4-inch high letters.
3. 2-1/2-inch to 6-inch Outside Diameter of Insulation or Pipe: 12-inch long color field, 1-1/4-inch high letters.
4. 8-inch to 10-inch Outside Diameter of Insulation or Pipe: 24-inch long color field, 2-1/2-inch high letters.
5. Over 10-inch Outside Diameter of Insulation or Pipe: 32-inch long color field, 3-1/2-inch high letters.

2.4 CEILING TAGS

A. Manufacturers:

1. Brady Corporation
2. Brimar
3. Champion America
4. Craftmark
5. Seton

B. Description: Steel with 3/4-inch diameter color coded head.

C. Color code as follows:

1. Yellow - HVAC equipment.
2. Red - Fire dampers/smoke dampers.
3. Blue - Heating/cooling valves.
4. Ceiling tile labels, machine generated, adhesive backed tape labels with black letters, clear tape.

PART 3 - EXECUTION

3.1 GENERAL - INSTALLATION

- A. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates riveted to equipment body.
- B. Identify piping, concealed or exposed, with plastic pipe markers.
- C. Coordinate names, abbreviations and other designations used in mechanical identification work with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

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- D. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples: Chiller No. 3, Air Handling Unit No. 42, Standpipe F12, and the like).
- E. Degrease and clean surfaces to receive adhesive for identification materials.
- F. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.
- G. Coordinate with the facility maintenance personnel to ensure consistency with the existing tagging system.
- H. Install all products in accordance with manufacturer's instructions.
- I. Manual Balancing Dampers: Provide 12-inch long orange marker ribbon to end of balancing damper handle.

3.2 PLASTIC NAMEPLATES

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners.
- B. Identify control panels and major control components outside panels with plastic nameplates riveted to equipment body.
- C. Identify thermostats with nameplates.

3.3 TAGS

- A. Use metal tags on piping 3/4-inch diameter and smaller.
- B. Tag balancing valves and major dampers with balanced GPM or CFM indicated after balancing is completed and accepted.
- C. Install tags with corrosion resistant chain.
- D. Small devices, such as in-line pumps, may be identified with tags.
- E. Identify valves with metal tags. Indicate valve function and the normally open or closed positions on the valve tag.
- F. Identify air terminal units and radiator valves with numbered plastic tags.
- G. Tag automatic controls, instruments, and relays. Key to control schematic.
- H. Install valve schedule at each mechanical room.

3.4 PLASTIC PIPE MARKERS

- A. Install plastic pipe markers complete around pipe in accordance with manufacturer's instructions.
- B. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20-feet (reduced to 10-feet in congested areas and

mechanical equipment rooms) 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. Locate near branches, valves, control devices, equipment connections, access doors, floor/wall penetrations.

3.5 CEILING TAGS

- A. Provide ceiling tags to locate valves, dampers, and equipment above accessible ceilings.
Locate in corner of ceiling tee grid closest to equipment.

END OF SECTION

SECTION 23 0593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. General Requirements and Procedures
2. Ductwork Pressure Testing
3. Fundamental Air Systems Balancing Procedures
4. Temperature Control Verification
5. Constant Volume Air Systems Balancing Procedures
6. Pre-Balance Reporting
7. Final Reports:
 - a. Report Requirements
 - b. General Report Data
 - c. System Diagrams
 - d. Fans
 - e. Duct Traverses
 - f. Diffusers/Registers/Grilles
 - g. Instrument Calibration
8. Additional Tests

1.2 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:

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1. Quality-Assurance Submittals: Submit two copies of evidence that the Testing, Adjusting, and Balancing (TAB) Agent and Project's TAB team members meet the qualifications specified in the "Quality Assurance" Article below.
2. Pre-Construction Phase Report:
 - a. Provide a pre-construction phase TAB Plan at least two weeks prior to the commencement of TAB work. This report is to include:
 - 1) A complete set of report forms intended for use on the Project, with data filled in except for the field readings. Forms to be Project-specific.
 - 2) Marked up shop drawings identifying all HVAC equipment to be balanced, and associated outlets and terminal devices.
 - 3) Identification of the type, manufacturer, and model of the actual instruments to be used, and clear indication of which instrument will be used to take each type of reading. Calibration certifications to be included.
 - 4) A narrative of Project-specific and/or non-standard TAB procedures to be used, and the equipment or systems to which they apply.
3. Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit two copies of the Contract Documents review report as specified in Part 3 of this Section.
4. Strategies and Procedures Plan: Submit two copies of the TAB strategies and step-by-step procedures as specified in Part 3 of this Section. Include a complete set of report forms intended for use on this Project.
5. Specify reports required because of editing procedures in Part 3 of this Section.
6. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by the TAB Agent.
7. Sample Report Forms: Submit two sets of sample TAB report forms.
8. Test Instrument Calibration: Submit proof of calibration within the last 6 months.
9. Final Report.
10. Provide additional submittals to commissioning authority as dictated in Commissioning Specifications.

1.5 QUALITY ASSURANCE

- A. Quality Assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 1. Acceptable TAB Agencies:
 - a. Northern California:

- 1) RSAnalysis, Inc.
 - 2) National Air Balance Company (NABCO)
 - 3) Mesa 3
2. Balance Firm Qualifications:
- a. General:
 - 1) Procure services of independent TAB agency to balance, adjust and test water circulating and air moving equipment and air distribution or exhaust systems. Minimum experience: 5 years.
 - 2) Provide proof of testing agency having successfully completed at least five projects of similar size and scope.
 - b. Testing and Balancing firm is certified by AABC and has a NEBB Certified Professional (CP) or a AABC Test and Balancer Engineer (TBE) on staff.
 - c. Industry Standards: Testing and Balancing will conform to AABC, and American National Standards Institute (ANSI) as follows:
 - 1) NEBB: Comply with Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
 - 2) AABC: Comply with National Standards for Total System Balance.
 - 3) ANSI:
 - a) S1.4 Specifications for sound level meters.
 - b) S1.11 Specifications for Octave-Band and Fractional-Octave-Band analog and digital filters.
 - c) ANSI S1.13 Methods for the Measurement of Sound Pressure Levels.
 - d. Test Observation: If requested, conduct tests in the presence of the Commissioning Authority, AHJ, Architect or the Architect's representative.
3. Code Compliance: Perform tests in the presence of the Authority Having Jurisdiction (AHJ) where required by the Authority Having Jurisdiction (AHJ).
4. Owner Witness: Perform tests in the presence of the Commissioning Authority, Architect, Architect's Representative, or Owner's representative.
5. Engineer Witness: The engineer or engineer's representative reserves the right to observe tests or selected tests to assure compliance with the specifications.
6. Simultaneous Testing: Test observations by the AHJ, the Owner's Authorized Representative and the engineer's representative need not occur simultaneously.
7. Do not perform TAB work until heating, ventilating, and air conditioning equipment has been completely installed and is operating continuously as required.

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8. Conduct air testing and balancing with clean filters in place. Clean strainers prior to performing hydronic testing and balancing.
9. TAB Conference: Meet with the Commissioning Authority, Owner's and the Architect's representatives on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days advance notice of scheduled meeting time and location.
 - a. Agenda Items: Include at least the following:
 - 1) Submittal distribution requirements.
 - 2) Contract Documents examination report.
 - 3) TAB plan.
 - 4) Work schedule and Project site access requirements.
 - 5) Coordination and cooperation of trades and subcontractors.
 - 6) Coordination of documentation and communication flow.
10. Certification of TAB Reports: This certification includes the following:
 - a. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - b. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
11. TAB Reports: Use standard forms from AABC.
12. Instrumentation Type, Quantity, and Accuracy: As described in AABC.
13. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 1. TAB Agency provides warranty for a period of 90 days following submission of completed report, during which time, Owner may request a recheck of up to 10 percent of total number of terminals, or resetting of outlet, coil, or device listed in the final TAB report.
 2. Guarantee: Meet the requirements of the following programs:
 - a. Provide a guarantee on AABC forms stating that the agency will assist in completing the requirements of the Contract Documents if the TAB Agent fails to

comply with the Contract Documents. Guarantee includes the following provisions:

- 1) The certified Agent has tested, adjusted, and balanced systems according to the Contract Documents.
- 2) Systems are balanced to optimum performance capabilities within design and installation limits.

1.7 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.
- C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- E. Report Forms: Test data sheets for recording test data in logical order.
- F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- J. TAB: Testing, Adjusting, and Balancing.
- K. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- L. Test: A procedure to determine quantitative performance of a system or equipment.
- M. Testing, Adjusting, and Balancing (TAB) Agent: The entity responsible for performing and reporting the TAB procedures.
- N. AABC: Associated Air Balance Council.
- O. NEBB: National Environmental Balancing Bureau.
- P. AMCA: Air Movement and Control Association.
- Q. CTI: Cooling Tower Institute.

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- R. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.8 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Notice: Provide 7 days advance notice for each test. Include scheduled test dates and times.
- C. Witness leakage and pressure tests carried out by Section 23 31 00, HVAC Ducts and Casings.
- D. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS AND PROCEDURES

- A. Project Conditions:
 - 1. Full Owner Occupancy: The Owner will occupy the site and existing building during the entire TAB period. Cooperate with the Owner during TAB operations to minimize conflicts with the Owner's operations.
 - 2. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during TAB operations to minimize conflicts with the Owner's operations.
 - 3. Non-Owner Occupancy: Complete balancing of building systems prior to Substantial Completion and owner occupancy.
- B. General Requirements:
 - 1. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and controls, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.
 - 2. Perform TAB work with doors, closed windows, and ceilings installed etc., to obtain simulated or project operating conditions. Do not proceed until systems scheduled for TAB are clean and free from debris, dirt and discarded building materials.
 - 3. Where Owner occupies building during the testing period, cooperate with Owner to minimize conflicts with Owner's operations.
- C. Examination:
 - 1. Examine Contract Documents to become familiar with project requirements and existing building record documents (if available) to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

- a. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
 - b. Verify that balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
 2. Examine approved submittal data of HVAC systems and equipment.
 3. Examine Project record documents described in Division 01, General Requirements.
 4. Examine Architect's and Engineer's design data, including Basis of Design, HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
 5. Examine equipment performance data, including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
 6. Coordinate requirements in system and equipment with this Section.
 7. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
 8. Examine system and equipment test reports.
 9. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
 10. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
 11. Examine equipment for installation and for properly operating safety interlocks and controls.
 12. Report deficiencies discovered before and during performance of TAB procedures.
- D. Preparation:
1. Prepare a TAB plan that includes strategies and step-by-step procedures.

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2. Complete system readiness checks and prepare system readiness reports. Verify the following:
 - a. Permanent electrical power wiring is complete.
 - b. Hydronic systems are filled, clean, and free of air.
 - c. Automatic temperature-control systems are operational.
 - d. Equipment and duct access doors are securely closed.
 - e. Balance, smoke, and fire dampers are open.
 - f. Isolating and balancing valves are open and control valves are operational.
 - g. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - h. Windows, doors and other portions of the building envelope can be closed so design conditions for system operations can be met.
3. Hold a pre-balancing meeting at least one week prior to starting TAB work.
 - a. Attendance is required by installers whose work will be tested, adjusted, or balanced.
4. Provide instruments required for TAB operations. Make instruments available to Architect to facilitate spot checks during testing.

E. General TAB Procedures:

1. Perform TAB procedures on each system according to the procedures contained in AABC and this Section.
2. Coordinate location of test probes prior to start of TAB procedures and make test probes available for Owner's tests after start of occupancy. Where required, cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.
3. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

F. Adjustment Tolerances:

1. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 5 percent of design for return and exhaust systems.
2. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

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3. Hydronic Systems: Adjust to within plus or minus 10 percent of design at coils and plus or minus 5 percent at system pumps and equipment.
4. Adjust supply, return, and exhaust air quantities to maintain pressurization in spaces indicated on Drawings. Note and document room-to-room pressurization and maintain these relationships. Adjust pressure controlled spaces to within plus or minus 0.01 in WC.

G. Recording and Adjusting:

1. Field Logs: Maintain written logs including:
 - a. Running log of events and issues.
 - b. Discrepancies, deficient or uncompleted work by others.
 - c. Contract interpretation requests.
 - d. Lists of completed tests.
2. Ensure recorded data represents actual measured or observed conditions.
3. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
4. Mark on drawings locations where traverse and other critical measurements were taken and cross reference location in final report.
5. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
6. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
7. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner's Authorized Representative, or Commissioning Agent.

3.2 DUCTWORK PRESSURE TESTING

- A. Test ductwork prior to connection to fan equipment. Repair leaks and retest until stipulated results are achieved.
- B. Provide air pressure testing of ductwork as noted below for various project types and systems:
 1. For other project types or systems: pressure test ductwork in accordance with SMACNA HVAC Air Duct Leakage Test Manual, of representative sections of installed ductwork totaling not less than the total installed duct areas noted below:
 - a. For variable air volume supply, return, or exhaust air systems' ductwork of higher than 2-inches pressure class: pressure test 40 percent of the total installed duct area.
 - b. For variable air volume supply, return, or exhaust air systems' ductwork of 2-inches or less pressure class: pressure test ductwork connected to 10-percent of

the total installed duct area of such ductwork, but not less than ductwork connected to two terminal units. Where the tested 10-percent fails to comply, then pressure test 40-percent of the total installed duct area.

- c. For constant air volume supply, return, or exhaust systems: pressure test 40-percent of the total installed duct area.
 2. Where tests are required, provide separate tests for each of supply, return and exhaust air systems.
 3. Where the tested 40-percent fails to comply with the requirements of this section, then pressure test 100-percent of the total installed duct area. Sections shall be selected by the building owner or the Architect and shall include sections of ductwork upstream and downstream of terminal units. Positive pressure leakage testing may be utilized for negative pressure ductwork.
 4. Area requirement of 40-percent of the total installed duct area is inclusive of ductwork located in shafts or outside building envelope.
- C. Test ductwork prior to connection to fan equipment. Repair leaks and retest until stipulated results are achieved. Pressure testing to meet the following leakage classifications below as a minimum (2012 SMACNA HVAC Air Duct Leakage Manual, Table 4-1):
1. Leakage class to be as defined below as a minimum.
 - a. Minimum Duct Leakage Classification

Duct Type	Leakage Class
Metal (Flexible excluded)	
Round and flat oval	3
Rectangular	6
 2. Testing machine: Meet requirements of SMACNA standards. Pacific Air Products "Port-O-Lab", Rolok, or United Sheet Metal
 3. Test supply systems prior to connecting terminal units.
 4. Perform tests in presence of Owner's Authorized Representative. Give 48 hours advance notice before commencement of each test.
 5. Test ductwork systems in sections as large as possible and record test results accordingly.
 6. Leak test grease exhaust ductwork per requirements of latest edition of NFPA-96 and local Mechanical Code.
 7. Coordinate testing with ceiling installation.
 - a. Provide sheet-metal plates and install between each duct test section (applies to main-to-main fittings, branch-to-branch fittings and main-to-branch fittings). At each plate location, fabricate joint with Ductmate. Insert 14 gauge sheet metal between Ductmate using a neoprene gasket on both sides of metal plate.

- b. Leave plates in place until isolated section has been tested and approved by Owner's Authorized Representative.
 - c. Once sections have passed test, remove plates and reattach Ductmate joints. After fan unit is running, test joint for leakage by using a mixture of soap and water. If noise or bubbling occurs, reseal joint. Owner's Authorized Representative to witness this procedure.
8. Test duct at 1.5 times the design air pressure, up to pressure class of the duct. Seal audible leaks.

3.3 FUNDAMENTAL AIR SYSTEMS BALANCING PROCEDURES

- A. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- B. Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible and their controls are connected and functioning.
- C. Prepare test reports for both fans and inlets and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross check the summation of required outlet volumes with required fan volumes.
- D. Prepare schematic diagrams of systems' "as-built" duct layouts.
- E. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- F. Check the airflow patterns from the outside-air louvers and dampers and the return-air and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- G. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- H. Verify that motor starters are equipped with thermal protection, sized for the connected load.
- I. Check dampers for proper position to achieve desired airflow path.
- J. Check for airflow blockages.
- K. Check that condensate drains are installed, trapped and primed and routed to drain.
- L. Check for readily observable leaks in air-handling unit components and ductwork.
- M. Use sheaves and pulleys to adjust the speed of belt drive fans to achieve design flow with motors running at 60 Hertz unless noted otherwise.

3.4 TEMPERATURE CONTROL VERIFICATION

- A. Verify that controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.

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- D. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Verify free travel and proper operation of control devices such as damper and valve operators.
- F. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.
- G. Confirm interaction of electrically operated switch transducers.
- H. Confirm interaction of interlock and lockout systems.

3.5 CONSTANT VOLUME AIR SYSTEMS BALANCING PROCEDURES

- A. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer. Adjust fans to deliver design airflow at the lowest possible speed.
 - 1. Measure fan static pressures to determine actual static pressure as follows:
 - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 2. Measure static pressure across each air-handling unit component under final balanced condition.
 - 3. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Recommend corrective action to align design and actual conditions.
 - 4. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
 - 5. Do not make fan-speed adjustments that result in motor loading greater than full load amps. Do not increase fan speed beyond fan class rating. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.
 - 6. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.
 - 7. Calibrate airflow measuring stations.

3.6 Pre-Balance Reporting

- A. Pre-Construction Phase Report:

1. Provide a pre-construction phase TAB Plan at least 2 weeks prior to the commencement of TAB work. This report is to include:
 - a. A complete set of report forms intended for use on the Project, with all data filled in except for the field readings. Forms to be Project-specific.
 - b. Marked up shop drawings identifying all HVAC equipment to be balanced, and associated outlets and terminal devices.
 - c. Identification of the type, manufacturer, and model of actual instruments to be used, and clear indication of which instrument will be used to take each type of reading. Calibration certifications are to be included.
 - d. A narrative of Project-specific and/or non-standard TAB procedures to be used, and the equipment or systems they apply to.
- B. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- C. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced.

3.7 FINAL REPORTS

- A. Report Requirements:
 1. General:
 - a. Computer generated in PDF format and tabulated, divided, and bookmarked into sections by tested and balanced systems.
 - b. Include a certification sheet in front of binder signed and sealed by the certified TAB engineer.
 - 1) Include a list of the instruments used for procedures, along with proof of calibration.
 - c. Final Report Contents: In addition to the certified field report data, include the following:
 - 1) Fan Curves
 - 2) Manufacturers Test Data
 - 3) Field test reports prepared by system and equipment installers
 - 4) Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data

B. General Report Data:

1. In addition to the form titles and entries, include the following data in the final report, as applicable:
 - a. Title Page
 - b. Name and Address of TAB Agent
 - c. Project Name
 - d. Project Location
 - e. Architect's Name and Address
 - f. Engineer's Name and Address
 - g. Contractor's Name and Address
 - h. Report Date
 - i. Signature of TAB Agent who Certifies the Report
 - j. Summary of Contents, Including the Following:
 - 1) Design versus Final Performance
 - 2) Notable Characteristics of Systems
 - 3) Description of System Operation Sequence if it varies from the Contract Documents
 - k. Nomenclature Sheets for Each Item of Equipment
 - l. Data for Terminal Units, including Manufacturer, Type Size, and Fittings
 - m. Notes to explain why certain final data in the body of reports vary from design values.
 - n. Test Conditions for Fans and Pump Performance Forms, Including the Following:
 - 1) Settings for Outside-, Return-, and Exhaust-air Dampers
 - 2) Conditions of Filters
 - 3) Cooling Coil, Wet- and Dry-bulb Conditions
 - 4) Face and Bypass Damper Settings at Coils
 - 5) Fan Drive Settings, including Settings and Percentage of Maximum Pitch Diameter
 - 6) Inlet Vane Settings for Variable-Air-Volume Systems
 - 7) Settings for Supply-air, Static-pressure Controller

8) Other System Operating Conditions that affect Performance

C. System Diagrams:

1. Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:
 - a. Quantities of Outside, Supply, Return, and Exhaust Airflows
 - b. Water and Steam Flow Rates
 - c. Duct, Outlet, and Inlet Sizes
 - d. Pipe and Valve Sizes and Locations
 - e. Terminal Units
 - f. Balancing Stations

D. Fans:

1. Fan Test Reports: For supply, return, and exhaust fans, include the following:
 - a. Fan Data: Include the following:
 - 1) System Identification
 - 2) Location
 - 3) Make and Type
 - 4) Model Number and Size
 - 5) Manufacturer's Serial Number
 - 6) Arrangement and Class
 - 7) Sheave Make, Size in Inches, and Bore
 - 8) Sheave Dimensions, Center-to-center and Amount of Adjustments in Inches
 - b. Motor Data: Include the following:
 - 1) Make and Frame Type and Size
 - 2) Horsepower and rpm
 - 3) Volts, Phase, and Hertz
 - 4) Full-load Amperage and Service Factor
 - 5) Sheave Make, Size in Inches, and Bore
 - 6) Sheave Dimensions, Center-to-center and Amount of Adjustments in Inches
 - 7) Number of Belts, Make, and Size

c. Test Data: Include design and actual values for the following:

- 1) Total Airflow Rate in cfm
- 2) Total System Static Pressure in Inches wg
- 3) Fan rpm
- 4) Discharge Static Pressure in Inches wg
- 5) Suction Static Pressure in Inches wg

E. Duct Traverses:

1. Include a diagram with a grid representing the duct cross-section and record the following:

a. Report Data: Include the following:

- 1) System and Air-handling Unit Number
- 2) Location and Zone
- 3) Duct Static Pressure in Inches wg
- 4) Duct Size in Inches
- 5) Duct Area in SF
- 6) Design Airflow Rate in cfm
- 7) Design Velocity in fpm
- 8) Actual Airflow Rate in cfm
- 9) Actual Average Velocity in fpm

F. Diffusers/Registers/Grilles:

1. For diffusers, registers and grilles, include the following:

a. Unit Data: Include the following:

- 1) System and Air-handling Unit Identification
- 2) Location and Zone
- 3) Test Apparatus Used
- 4) Area Served
- 5) Air-terminal-device Make
- 6) Air-terminal-device Number from System Diagram
- 7) Air-terminal-device Type and Model Number

- 8) Air-terminal-device Size
- 9) Air-terminal-device Effective Area in SF
- b. Test Data: Include design and actual values for the following:
 - 1) Airflow Rate in cfm
 - 2) Air Velocity in fpm
 - 3) Final Airflow Rate in cfm
 - 4) Final Velocity in fpm
 - 5) Space Temperature in Degrees F

G. Instrument Calibration:

- 1. For instrument calibration, include the following:
 - a. Report Data: Include the following:
 - 1) Instrument Type and Make
 - 2) Serial Number
 - 3) Application
 - 4) Dates of Use
 - b. Dates of Calibration

3.8 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 0700
HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Type A, Flexible Glass Wool Blanket
2. Type B, Duct Liner
3. Type F, Closed-Cell Polyisocyanurate Rigid Foam Board
4. Type 1, Glass Wool Pipe Insulation
5. Type 2, Flexible Elastomeric Pipe Insulation
6. Jacketing
7. Accessories
8. Duct Insulation Accessories
9. Duct Insulation Compounds

1.2 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:

1. Piping and duct insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

1.4 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
1. Installer qualifications.
 2. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any) for each type of product indicated.
 3. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation

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materials, sealers, attachments, cements, and jackets with requirements indicated.
Include dates of tests.

4. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

5. Submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

- B. In addition, meet the following:

1. Formaldehyde Free: Should be third-party certified with UL Environment Validation.
2. Recycled Content: A minimum of 40 percent post-consumer recycled glass content certified and UL validated.
3. Low Emitting Materials: For all thermal and acoustical applications of Glass Mineral Wool Insulation products, provide materials complying with the testing and products requirements of UL GREENGUARD Gold Certification.
4. Installer to have minimum 5 years' experience in the business of installing insulation.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 FIRE HAZARD CLASSIFICATION

- A. Maximum fire hazard classification of the composite insulation construction as installed to be not more than a Flame Spread Index (FSI) of 25 and Smoke Developed Index (SDI) of 50 as tested by current edition of ASTM E84 (NFPA 255) method.
- B. Test pipe insulation in accordance with the requirements of current edition of UL "Pipe and Equipment Coverings R5583 400 8.15".
- C. Test duct insulation in accordance with current edition of ASTM E84, UL 723, NFPA 255, NFPA 90A and NFPA 90B.

PART 2 - PRODUCTS

2.1 TYPE A, FLEXIBLE GLASS WOOL BLANKET

- A. Acceptable Manufacturers:

1. Certainteed
2. Johns Manville
3. Knauf

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4. Owens-Corning
- B. ASTM C553, Type 1, Class B-2; flexible blanket.
- C. 'K' Value: 0.27 BTU*in/(hr*sf*F) at 75 degrees F installed, maximum service temperature: 250 degrees F.
- D. Density: 0.75 pounds per cubic foot.
- E. DBDE-free. UL/E validated to be formaldehyde-free.
- F. Vapor Barrier Jacket: FSK aluminum foil reinforced with glass wool yarn and laminated to fire resistant Kraft, secured with UL listed pressure sensitive tape or outward clinched expanded staples and vapor barrier mastic as needed.
- 2.2 TYPE B, DUCT LINER**
- A. Acceptable Manufacturers:
1. Certainteed
 2. Johns Manville
 3. Knauf
 4. Owens-Corning
- B. ASTM C1071; flexible blanket.
- C. 'K' Value: ASTM C518, 0.25 BTU*in/(hr*sf*F) at 75 degrees F, maximum service temperature: 250 degrees F.
- D. Noise Reduction Coefficient: 0.65 or higher based on ASTM C 423 "Type A mounting."
- E. Maximum Velocity on Mat or Coated Air Side: 5,000 FPM.
- F. Adhesive: UL listed waterproof type.
- G. Fasteners: Duct liner galvanized steel pins, welded or mechanically fastened.
- H. Erosion-Resistant Surfaces: UL 181.
- I. ASTM G21 and ASTM G22 Microbial Growth Resistance.
- J. UL GREENGUARD Certified does not support the growth of mold, fungi, or bacteria per ASTM C 1338 and meets UL Environment GREENGUARD Microbial Resistance Listing per UL 2824- "GREENGUARD Certification Program Method for Measuring Microbial Resistance". DBDE-free. UL/E validated to be formaldehyde-free.
- 2.3 TYPE F, CLOSED-CELL POLYISOCYANURATE RIGID FOAM BOARD**
- A. Acceptable Manufacturers:
1. Johns Manville

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2. Certainteed
 3. Knauf
 4. RMax
- B. ASTM C1289, Type 1, Class 1.
- C. Thermal Conductivity: 0.16 BTU*in/(hr*sf*F).
- D. Service Temperature: -100 degrees F to 250 degrees F.
- E. Jacketing: 0.024-inch thick multi-layered laminate with tensile strength of 187 lb/inch, puncture resistance of 68 pounds per ASTM D1000, emittance of 0.03 per ASTM C1371, WVTR of 0.00 perm per ASTM E96, and service temperature of -94 degrees F to 248 degrees F, as manufactured by 3M, VentureClad1579GCW-E, or approved equivalent.

2.4 TYPE 1, GLASS WOOL PIPE INSULATION

- A. Acceptable Manufacturers:
1. Certainteed
 2. Johns Manville
 3. Knauf
 4. Owens-Corning
- B. Glass Wool: ASTM C547 Type I and IV; rigid molded, noncombustible.
1. Thermal Conductivity Value: As indicated in the insulation tables below.
 2. Maximum Service Temperature: 850 degrees F to 1000 degrees F.
- C. Vapor Retarder Jacket: White Kraft paper reinforced with glass wool and bonded to aluminum foil, secure with self-sealing longitudinal laps and butt strips or vapor barrier mastic.

2.5 TYPE 2, FLEXIBLE ELASTOMERIC PIPE INSULATION

- A. Acceptable Manufacturers:
1. Insulation:
 - a. Armacell LLC Armaflex
 - b. K-Flex
 - c. Or approved equivalent.
 2. Glue:
 - a. Armacell LLC Armaflex Low VOC Adhesive
 - b. K-Flex

- c. Or approved equivalent.
- 3. Paint:
 - a. Armacell LLC Armaflex
 - b. K-Flex
 - c. Or approved equivalent.
- B. Elastomeric Foam: ASTM C534; flexible, cellular elastomeric, molded or sheet.
 - 1. Thermal Conductivity Value: As indicated in the insulation tables below.
 - 2. Maximum Service Temperature of 220 degrees F.
 - 3. Maximum Flame Spread: 25.
 - 4. Maximum Smoke Developed: 50 (1-inch thick and below).
 - 5. Vapor Retarder Jacket, for over 1-inch insulation thickness: White Kraft paper reinforced with glass wool and bonded to aluminum foil, secure with self-sealing longitudinal laps and butt strips or vapor barrier mastic.
 - 6. Connection: Waterproof vapor retarder adhesive as needed.
 - 7. UV Protection: UV outdoor protective coating per manufacturer's requirements.
- C. Glue: Contact adhesive specifically manufactured for cementing flexible elastomeric foam.
- D. Paint (for exterior insulation only): Nonhardening high elasticity type, specifically manufactured as protective covering of flexible elastomeric foam insulation for prevention of degradation due to exposure to sunlight and weather.

2.6 JACKETING

- A. Acceptable Manufacturers:
 - 1. ITW Insulation Systems
 - 2. General Insulation Company
 - 3. 3M
 - 4. Or approved equivalent.
- B. Insulation Jacketing and Insulation Jacketing Tape for Ductwork and Piping: 0.024-inch thick multi-layered laminate with tensile strength of 187 lb/inch, puncture resistance of 68 pounds per ASTM D1000, emittance of 0.03 per ASTM C1371, WVTR of 0.00 perm per ASTM E96, and service temperature of -94 degrees F to 248 degrees F, as manufactured by 3M, VentureClad1579GCW-E, or approved equivalent.
- C. PVC preformed molded insulation covers, for piping. Zeston or approved equivalent.
- D. Stainless Steel Jacket: Type 304 stainless steel, 0.010-inch, smooth finish.

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2.7 ACCESSORIES

- A. Acceptable Manufacturers:
 - 1. ITW Insulation Systems
 - 2. Or approved equivalent.
- B. Equipment Insulation Jacketing: Presized glass cloth, not less than 7.8 ounces/sq.yd., except as otherwise indicated. Coat with gypsum based cement.
- C. Equipment Insulation Compounds: Provide adhesives, cement, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.
- D. General: Provide staples, bands, wire, wire netting, tape corner angles, anchors, stud pins and metal covers as recommended by insulation manufacturer for applications indicated.
Accessories, i.e., adhesives, mastics, cements and tape to have the same flame and smoke component ratings as the insulation materials with which they are used. Shipping cartons to bear a label indicating that flame and smoke ratings do not exceed those listed above. Provide permanent treatment of jackets or facings to impart flame and smoke safety. Provide non-water-soluble treatments. Provide UV protection recommended by manufacturer for outdoor installation.

2.8 DUCT INSULATION ACCESSORIES

- A. Acceptable Manufacturers:
 - 1. Certainteed
 - 2. Johns Manville
 - 3. Owens-Corning
- B. Staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.

2.9 DUCT INSULATION COMPOUNDS

- A. Acceptable Manufacturers:
 - 1. Certainteed
 - 2. Johns Manville
 - 3. Owens-Corning
- B. Cements, adhesives, coatings, sealers, protective finishes and similar accessories as recommended by insulation manufacturer for applications indicated. Comply with South Coast Air Quality Management District (SCAQMD) Rule #1168 in accordance with LLE EQ 4.1.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Verification of Conditions:

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1. Do not apply insulation until pressure testing and inspection of ducts and piping has been completed.
 2. Examine areas and conditions under which duct and pipe insulation will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Preparation: Clean and dry surfaces to be insulated.
- C. Installation:
1. Insulation: Continuous through walls, floors and partitions except where noted otherwise.
 2. Piping and Equipment:
 - a. Install insulation over clean, dry surfaces with adjoining sections firmly butted together and covering surfaces. Fill voids and holes. Seal raw edges. Install insulation in a manner such that insulation may be split, removed, and reinstalled with vapor barrier tape on strainer caps and unions. Do not install insulation until piping has been leak tested and has passed such tests. Do not insulate manholes, equipment manufacturer's nameplates, handholes, and ASME stamps. Provide beveled edge at such insulation interruptions. Repair voids or tears.
 - b. Cover insulation on pipes above ground, outside of building, with aluminum jacketing. Position seam on bottom of pipe.
- D. Cover insulation on exposed refrigerant piping above ground, outside of building with heavy duty multi-layered laminated jacketing tape. Position seams on bottom of pipe. Use Venture Tape VentureClad Plus 1579GCW-E or approved equal.
- E. Provide accessories as required. See Part 2 Article "Accessories" above.
- F. Protection and Replacement: Installed insulation during construction. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- G. Labeling and Marking: Provide labels, arrows and color on piping and ductwork. Attach labels and flow direction arrows to the jacketing per Section 23 05 53, Identification for HVAC Piping, Ductwork and Equipment.
- H. Ductwork:
1. Install insulation in conformance with manufacturer's recommendations to completely cover duct.
 2. Butt insulation joints firmly together and install jackets and tapes smoothly and securely.
 3. Apply duct insulation continuously through sleeves and prepared openings, except as otherwise specified. Apply vapor barrier materials to form complete unbroken vapor seal over insulation.
 4. Coat staples and seals with vapor barrier coating.
 5. Cover breaks in jacket materials with patches of same material as vapor barrier. Extend patches not less than 3-inches beyond break or penetration on all directions and secure

with adhesive and staples. Seal staples and joints with vapor barrier coating.

6. Fill jacket penetrations. i.e., hangers, thermometers and damper operating rods, and other voids in insulation with vapor barrier coating. Seal penetration with vapor barrier coating. Insulate hangers and supports for cold duct in un-conditioned spaces to extent to prevent condensation on surfaces.
 7. Seal and flash insulation terminations and pin punctures with reinforced vapor barrier coating.
 8. Continue insulation at fire dampers and fire/smoke dampers up to and including those portions of damper frame visible at outside of the rated fire barrier. Insulating terminations at fire dampers in accordance with this Section.
 9. Do not conceal duct access doors with insulation. Install insulation terminations at access door in accordance with this Section.
- I. Insulated Pipe Exposed to Weather: Where piping is exposed to weather, cover insulation with aluminum jacket. Seal watertight jacket per manufacturer's recommendations. Install metal jacket with 2-inch overlap at longitudinal and butt joints with exposed lap pointing down. Secure jacket with stainless-steel draw bands 12-inches on center and at butt joints.
- J. Insulation Shields: Provide hangers and shields (18 gauge minimum) outside of insulation for cold piping (<60 degrees F). Hot water piping hangers may penetrate insulation to contact pipe directly. Provide 18-inch long, noncompressible insulation section at insulation shields for lines 2-inches and larger (hot and cold) piping.
- K. Ductwork Surfaces to be Insulated:

Item to be Insulated	System Insulation Type	Duct Size	Insulation Thickness
Supply ductwork where duct is not specified to be lined.	A	All	1.5-inch
Return ductwork where duct is not specified to be lined.	--	All	None
Outside Air Ducts	A	All	3-inch
Exhaust ducts within 10-feet of exterior	A	All	3-inch

1. Note: Insulation thickness shown is a minimum. If state codes require additional thickness, then provide insulation thickness per code requirements.

- L. Piping Surfaces to be Insulated:

Item to be Insulated	System Insulation Type	Conductivity Range (Btu-inch per	Pipe Size (Inches)	Insulation Thickness (Inches)
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		hour per SF per degrees F)		
Refrigerant Suction and Liquid Piping (40F to 60F)	2	0.21-0.27 at a mean rating temperature of 75 degrees F	<1 1 to <1.5 1.5 to <4 4 to <8 >= 8	0.75 0.75 1.0 1.0 1.0
Refrigerant Suction and Liquid Piping (<=40F)	2	0.20-0.26 at a mean rating temperature of 50 degrees F	<1 1 to <1.5 1.5 to <4 4 to <8 >= 8	1.0 1.5 1.5 1.5 1.5
Refrigerant Hot Gas Piping for VFR Systems	2	0.20-0.26 at a mean rating temperature of 50 degrees F	All	0.5
Condensate Drain Piping	1, 2	0.21-0.27	All	1/2-inch

1. Note: Insulation thickness shown is a minimum. If state code requires additional thickness, then provide insulation thickness per code requirements.

3.2 TYPE A, FLEXIBLE GLASS WOOL BLANKET

- A. Install insulation in conformance with manufacturer's recommendations and requirements.
- B. Duct Wrap: Cover air ducts per insulation table except ducts internally lined where internal duct lining is adequate to achieve adequate insulating values to meet local Energy Codes (indicate on shop drawings, locations where duct wrap is planned to be omitted and indicate internal duct lining insulating values to confirm they will meet the Energy Code.) Wrap tightly with circumferential joints butted and longitudinal joints overlapped minimum of 2-inches. On ducts over 24-inches wide, additionally secure insulation with suitable mechanical fasteners at 18-inches on center. Circumferential and longitudinal joints stapled with flare staples 6-inches on center and covered with 3-inch wide, foil reinforced tape.

3.3 Type B, Duct Liner

- A. Install insulation in conformance with manufacturer's recommendations and requirements.
- B. Duct Liners: Mat finish surface on air stream side. Secure insulation to cleaned sheet metal duct with continuous (minimum 90) percent coat of adhesive. Secure liner with mechanical fasteners

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15-inches on center or per manufacturer requirements. Accurately cut liner and thoroughly coat ends with adhesive. Butt joints tightly. Top and bottom sections of insulation overlap sides. Factory/field coat exposed edges. Metal nosing for exposed leading or transverse edges and when velocity exceeds 3500 FPM or manufacturer rating on exposed edges. Keep duct liner clean and free from dust. At completion of Project, vacuum duct liner if it is dirty or dusty. Do not use small pieces. If insulation is installed without horizontal, longitudinal, and end joints butted together, installation will be rejected and work removed and replaced with work that conforms to this Specification.

3.4 TYPE F, CLOSED-CELL POLYISOCYANURATE RIGID FOAM BOARD

- A. Install insulation in conformance with manufacturer's recommendations and requirements.

3.5 TYPE 1, GLASS WOOL PIPE INSULATION

- A. See General Installation Requirements above.
- B. Install insulation in conformance with manufacturer's recommendations and requirements.
- C. Lap seal insulation with waterproof adhesive. Do not use staples or other methods of attachment which would penetrate vapor barrier. Apply fitting covers with seated tacks and vapor barrier tape.
- D. Apply insulation to pipe and seal with self-sealing lap. Use self-sealing butt strips to seal butt joints. Insulate fittings, valves and unions with single or multiple layers of insulation and cover to match pipe or use preformed PVC molded insulation covers.

3.6 TYPE 2, FLEXIBLE ELASTOMERIC PIPE INSULATION

- A. Flexible Elastomeric Insulation:

1. Slip insulation on pipe prior to connection. Butt joints sealed with manufacturer's adhesive. Insulate fitting with miter-cut pieces. Cover insulation exposed to weather and below grade with two coats of finish as recommended by manufacturer.

- B. Flexible Elastomeric Tubing:

1. Flexible Elastomeric Tubing: Slip insulation over piping or, if piping is already installed, slit insulation and snap over piping. Joints and butt ends must be adhered with 520 adhesive.

- C. See General Installation Requirements above.

- D. Install insulation in conformance with manufacturer's recommendations and requirements.

- E. Slip insulation on pipe prior to connection. Butt joints sealed with manufacturer's adhesive. Insulate fitting with miter-cut pieces. Cover insulation exposed to weather and undergrade with two coats of finish as recommended by manufacturer.

- F. Install in accordance with manufacturer's instructions for below grade installation.

3.7 Jacketing

- A. See General Installation Requirements above.

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- B. Install in accordance with manufacturer's instructions.

3.8 Accessories

- A. Install insulation in conformance with manufacturer's instructions, recommendations and requirements.
- B. See General Installation Requirements above.
- C. Furnish and install accessories for all insulation types listed in this Section.

3.9 Duct Insulation Accessories

- A. Install insulation in conformance with manufacturer's recommendations and requirements.

3.10 Duct Insulation Compounds

- A. Install insulation in conformance with manufacturer's recommendations and requirements.

END OF SECTION

SECTION 23 2113
HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
1. Refrigerant Piping

1.2 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

- B. In addition, provide:

1. Welding Certificates: Copies of certificates for welding procedures and personnel.
2. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:
 - a. Test procedures used.
 - b. Test results that comply with requirements.
 - c. Failed test results and corrective action taken to achieve requirements.
3. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at project site.
4. Grooved couplings, fittings, valves, and specialties: Show grooved joint couplings and fittings on Shop Drawings and product submittals, and specifically identify with the applicable coupling style number.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. Installer Qualifications: Company specializing in performing work of the type specified in this Section, with documented experience.

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2. Welder Qualifications: Certify in accordance with ASME (BPV IX).
3. ASME Compliance: Comply with ASME B31.9 "Building Services Piping" for materials, products, and installation. Provide safety valves and pressure vessels with the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 01.
4. Grooved couplings, fittings, valves, and specialties: Provide all grooved couplings, fittings, valves, and specialty products from a single manufacturer. Utilize only grooving tools from the same manufacturer as the grooved components. Date-stamp all castings used for couplings housings, fittings, or valve and specialty bodies for quality assurance and traceability.
5. Refrigerant Piping:
 - a. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX "Welding and Brazing Qualifications."
 - b. ASHRAE Standard: Comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
 - c. ASME Standard: Comply with ASME B31.5, "Refrigeration Piping."
 - d. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical" or UL 429 "Electrically Operated Valves."

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 REFRIGERANT PIPING

- A. Piping:
 1. Copper Tube: ASTM B 280, Type ACR, annealed-temper tube, clean, dry and capped.
 - a. Fittings: ASME B16.22 wrought copper.
 - b. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy (15 percent Silver).
- B. Valves:
 1. Manufacturers:
 - a. Hansen Technologies Corporation
 - b. Henry Technologies
 - c. Danfoss Flomatic

- d. Substitutions: See Section 23 00 00, HVAC Basic Requirements, Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
2. Packaged Ball Valves:
- a. Two piece bolted forged brass body with Teflon ball seals and copper tube extensions, brass seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of and maximum temperature of 300 degrees F.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Install per manufacturer's written instructions and requirements.
- B. Preparation:
1. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
 2. Remove scale and dirt on inside and outside before assembly.
 3. Prepare piping connections to equipment with flanges or unions.
 4. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- C. Above Grade Piping Installation:
1. Install per manufacturer's written instructions and requirements.
 2. Install heating water, glycol, condenser water, piping to ASME B31.9 requirements. Install chilled water piping to ASME B31.5 requirements.
 3. Route piping in orderly manner, parallel to building structure, and maintain gradient.
 4. Install piping to conserve building space and to avoid interference with use of space.
 5. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
 6. Sleeve pipe passing through partitions, walls and floors allowing adequate space for pipe insulation.
 7. Slope piping at 0.2 percent upward in direction of flow and arrange to drain at low points.
 8. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
 9. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

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10. Drawings are diagrammatic and do not necessarily show top connections in all cases.
Install branch connections to mains using tee fittings in main, with takeoff coming out of the top unless trade coordination conditions preclude it.
11. Anchor piping for proper direction of expansion and contraction.
12. Inserts:
 - a. Provide inserts for placement in concrete formwork.
 - b. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - c. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4-inches.
 - d. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - e. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.
13. Pipe Hangers and Supports:
 - a. Install in accordance with Division 23, HVAC, Hangers and Supports.
 - b. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
 - c. Place hangers within 12-inches of each horizontal elbow.
 - d. Use hangers with 1-1/2-inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - e. Support vertical piping at top, bottom, and not less than every other floor. Support riser piping independently of connected horizontal piping.
 - f. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - g. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.
 - h. Provide copper plated hangers and supports for copper piping.
 - i. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
14. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
15. Provide access where valves and fittings are not exposed.
16. Use eccentric reducers to maintain top of pipe level.

17. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

18. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.

D. Field Quality Control:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.

3. Flush system with clean water. Clean strainers.

4. Isolate equipment from piping. If a valve is used to isolate equipment, provide closure capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.

5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

6. Perform the following tests on hydronic piping:

- a. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
- b. While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.
- c. Check expansion tanks to determine that they are not air bound and that system is full of water.
- d. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure not-to-exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."
- e. After hydrostatic test pressure has been applied for at least four hours, examine piping, joints and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
- f. Prepare written report of testing.

E. Flushing and Cleaning of Piping Systems:

1. Clean piping systems thoroughly. Purge pipe of construction debris and contamination before placing the piping systems in service. Provide temporary connections for cleaning, purging, and circulating fluids through the piping system.

2. Use temporary strainers and temporary pumps that can create fluid velocities up to 10 feet per second to flush and clean the piping systems. Do not use Owner's permanent

strainers to trap debris during pipe flushing operations. Fit the temporary construction strainers with a line size blowoff valve.

3. When constructing minor piping modifications or additions, verify with Owner if the Owner's pumps and strainers can be used for flushing and chemical cleaning operations. When the flushing and cleaning operations are complete, ensure the strainer baskets and screens installed in the piping systems permanent strainers are replaced with clean elements. Keep temporary strainers in service until the equipment has been tested, then replace straining element with a new strainer and clean and deliver the old straining elements to Owner. Fit the Owner's strainers with a line size blowoff valve.
4. Install bypass piping or hoses at the supply and return piping connections at heat exchangers, chillers, cooling towers, pumps, and cooling coils, etc., to prevent debris from being caught or causing damage to equipment which will be connected to the piping system.
5. Circulate a chemical cleaner in refrigerant piping systems to remove mill scale, grease, oil, and silt. Cleaner to be selected by chemical treatment vendor on project. Circulate for 48 hours, flush system and replace with clean water. Dispose of chemical solution in accordance with local codes. The refrigerant system should then be treated with chemicals and inhibitors to be selected by chemical treatment vendor on project. When the chemical cleaning is complete, remove, clean, and reinstall all permanent screens. Notify Owner so that the reinstallation of clean strainer screens may be witnessed.

F. Pipe Painting Requirements:

1. Paint all ferrous metal pipe including flanges. Do not paint flange bolts, washers and nuts. At flexible coupling the only the flanges are to be painted. All rubber portions are to remain unpainted.
2. Paint exterior uninsulated steel piping with exterior latex, semi-gloss (AE), Master Painters Institute MPI 11, suitable for metallic surfaces B, Haze Gray color.
3. Use ready-mixed (including colors) paint. Prime paint with pigment and vehicle, compatible with substrate and finish coats specified. Volatile Organic Compounds (VOC) content of paint materials shall not exceed 50g/l for exterior latex paints and primers. Lead-based paint is not permitted.
4. Do not apply coating when air or substrate conditions are:
 - a. Less than 5 degrees F above dew point.
 - b. Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the product manufacturer.
5. Do no exterior painting when it is windy and dusty. Do not paint in direct sunlight or on surfaces that the sun will soon warm.
6. Apply only on clean, dry and frost-free surface. Remove all materials the will affect the ability of the paint to adhere to the pipe including painted pipe identification labels.
7. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign. Remove loose mill scale, rust, and paint, by hand or power tool cleaning. All

surfaces are to be dry at the time paint is applied.

8. Apply paint in two coats; prime, and finish. Apply each coat evenly and cover substrate completely. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions.
9. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects. Apply by brush, roller or spray.

3.2 REFRIGERANT PIPING INSTALLATION

- A. Install systems in accordance with ASHRAE Standard 15.
- B. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.
- C. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
- D. Flood piping system with nitrogen when brazing.
- E. Follow ASHRAE Standard 15 procedures for charging and purging of systems and for disposal of refrigerant.
- F. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.
- G. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.
- H. Fully charge completed system with refrigerant after testing.
- I. Field Quality Control:
 1. Test refrigeration system in accordance with ASME B31.5.
 2. Pressure test system with dry nitrogen to 200 PSI. Perform final tests at 27-inches vacuum and 200 PSI using electronic leak detector. Test to no leakage.

END OF SECTION

SECTION 23 3100
HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Ductwork, Joints and Fittings
2. Insulated Flexible Duct
3. Drain Pans
4. Ductwork Joint Sealers and Sealants

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 23 05 29, Hangers and Supports for HVAC Piping, Ductwork and Equipment.
2. Section 23 05 93, Testing, Adjusting, and Balancing for HVAC.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Welding Certificates
2. Field Quality Control Reports

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. NFPA Compliance:
 - a. NFPA 90A Installation of Air Conditioning and Ventilating Systems.
 - b. NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

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2. Comply with NFPA 96, Ventilation Control and Fire Protection of Commercial Cooking Operations, Ch. 3, Duct System for range hood ducts, unless otherwise indicated.
3. Comply with SMACNA's HVAC Duct Construction Standards - Metal and Flexible for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Provide sheet metal materials free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
4. Provide ductwork pressure testing and leakage testing per Section 23 05 93, Testing, Adjusting and Balancing for HVAC.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select size and type of air-moving and distribution equipment and other air system components. Duct design is generally diagrammatic and is not meant to be scaled. Major changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

PART 2 - PRODUCTS

2.1 DUCTWORK, JOINTS AND FITTINGS

- A. Manufacturers:
 1. Ductmate
 2. Lindab Inc.
 3. Nexus Inc.
 4. SEMCO
 5. United McGill Corporation
 6. Ward Industries
- B. Materials:
 1. Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, lock-forming quality, ASTM A 653/A 653M FS Type B, with G90/Z275 coating. Ducts to have mill phosphatized finish for surfaces exposed to view.
- C. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

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1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
 2. Deflection: Duct systems not-to-exceed deflection limits according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible.
 3. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
- D. Formed-On Flanges: construct according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, Figure 1-4, using corner, bolt, cleat, and gasket details.
1. Duct Size: Maximum 30-inches wide and up to 2-inch wg pressure class.
 2. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.
 3. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19-inches and larger and 0.0359-inch thick or less, with more than 10 SF of nonbraced panel area unless ducts are lined.
- E. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of material specified in this Section according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible.
1. Ducts up to 20-inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
 2. Ducts 21- to 72-inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
 3. Ducts Larger than 72-inches in Diameter: Companion angle flanged joints per SMACNA HVAC Duct Construction Standards-Metal and Flexible, Figure 3-2.
 4. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
- F. 90-Degree Tees and laterals and Conical Tees: Fabricate to comply with SMACNA's HVAC Duct Construction Standards-Metal and Flexible, with metal thicknesses specified for longitudinal-seam straight ducts.
- G. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.
- H. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows to be 1.5 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's HVAC Duct Construction Standards-Metal and flexible, unless otherwise indicated.
 2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg (minus 500 to plus 500 Pa):

- a. Ducts 3- to 36-inches in Diameter: 0.034-inch .
- b. Ducts 37- to 50-inches in Diameter: 0.040-inch.
- c. Ducts 52- to 60-inches in Diameter: 0.052-inch.
- d. Ducts 62- to 84-inches in Diameter: 0.064-inch.
3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:
 - a. Ducts 3- to 26-inches in Diameter: 0.034-inch.
 - b. Ducts 27- to 50-inches in Diameter: 0.040-inch.
 - c. Ducts 52- to 60-inches in Diameter: 0.052-inch.
 - d. Ducts 62- to 84-inches in Diameter: 0.064-inch.
4. 90-Degree, Two-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
5. Round Elbows:
 - a. 8-inches and Less in Diameter: Fabricate die-formed elbows for 45 and 90-degree elbows and pleated elbows for 30, 45, 60 and 90 degrees only. Fabricate nonstandard bend-angle configurations or non-standard diameter elbows with gored construction.
 - b. 9 through 14-inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60 and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
 - c. Larger than 14-inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
6. Die-Formed Elbows for Sizes through 8-inches in Diameter and Pressures 0.040-inch thick with two-piece welded construction.
7. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
8. Pleated Elbows for Sizes through 14-inches in Diameter and Pressures through 10-inch wg (2500 Pa): 0.022-inch.
9. Not acceptable:
 - a. Corrugated or flexible metal duct.
 - b. Adjustable elbows.

2.2 INSULATED FLEXIBLE DUCT

- A. Manufacturers:

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1. ATCO
 2. Flexmaster
 3. J.P. Lamborn Co.
 4. Hart and Cooley
- B. Construction: Standard factory fabricated product. Inner wall: Impervious vinyl or chlorinated polyethylene, permanently bonded to a vinyl or zinc-coated spring steel helix.
- C. Insulation: Fiberglass blanket insulation covered by an outer wall of vinyl or fiberglass-reinforced metalized vapor barrier.
- D. Listing: UL 181 listed Class 1 flexible air duct material. Overall thermal transmission: No more than 0.25 BTU/in or hr/sq. degrees F at 75 degrees F differential, per ASTM C335.
- E. Vapor transmission value no more than 0.10 perm, per ASTM E96.
- F. Pressure Rating: 4-inch wg positive pressure and 1-inch wg negative pressure.
- G. Performance Air Friction Correction Factor: 1.3 maximum at 95 percent extension. Working air velocity: Minimum 2000 FPM.
- H. Flame Spread Rating: No more than 25.
- I. Smoke Development Rating: No more than 50 as tested per ASTM E84.
- J. Insertion Loss: Minimum attenuation of 29 DB for 10-foot straight length at 8-inch diameter at 500 Hz.

2.3 DRAIN PANS

- A. Primary Drain Pans: Stainless Steel, Fabricated in accordance with ASTM A167 and A480.
- B. Secondary Drain Pans: Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A 653/A 653M FS Type B, with G90/Z275 coating.

2.4 DUCTWORK JOINT SEALERS AND SEALANTS

- A. Manufacturers:
1. Ductmate
 2. Duro Dyne
 3. Hardcast
 4. United McGill Corporation
 5. Vulkem
 6. Foster
 7. Childer

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- B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
- C. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure and leakage class of ducts.
- D. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E 84.
- E. Water Based Sealant for Brush-On Application: Flexible, adhesive sealant, resistant to UV light, UL-181A, and UL-181-B listed, complying with NFPA requirements for Class 1 ducts. Min. 69 percent solids, nonflammable. Hardcast Versa-Grip 181; Childers CP-146; Foster 32-19 for SMACNA 1/2, 1, 2, 3, 4, 6, and 10-inch WG duct classes, and SMACNA Seal Class A, B, or C.
- F. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C920, Type S, Grade NS, Class 25, Use O.
- G. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.
- H. Polyurethane Sealant: General-purpose, exterior use, non-brittle sealant for gunned application. Vulkem 616 or equal.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. General: Use the following pressure seal, and leakage class(es) in design of ductwork specified in this section unless otherwise noted on Drawings.

SYSTEM	PRESSURE CLASS (Inches of Water)	SEAL CLASS	LEAKAGE CLASS ROUND DUCTS	LEAKAGE CLASS RECTANGULAR DUCTS
Medium pressure supply (fan to terminal unit)	0.5-inch higher than air handlers discharge pressure (min 4-inch pressure class).	A	3	6
Low pressure (downstream of terminal unit)	+ 1-inch	A	3	6
Return and exhaust	0.5-inch more negative than return/exhaust fan pressure or -2-inch pressure class, whichever is more negative.	A	3	6

- B. Ductwork Installation:

1. General: Install entire duct system in accordance with drawings, Specifications, and latest issues of local Mechanical Code, NFPA 90A, and SMACNA Duct Construction Manual. At Contractor's option, rectangular ductwork may be resized to maintain an equivalent air velocity and friction rate, while maintaining a maximum aspect ratio of 3. Remove markings and tagging from ductwork exterior surface in mechanical rooms and other locations where ductwork is exposed.
2. The duct layout shown on the Contract Drawings is diagrammatic in nature. Coordinate the ductwork routing and layout, and make alterations to the ductwork routing and layout to eliminate physical interferences. Where deviations in the ductwork routing as shown in the Contract Drawings are required, alterations may be made so as not to compromise the air flow, pressure drop, and sound characteristics of the duct fitting or duct run as shown on the Contract Drawings. In the event Architect determines that the installed ductwork is inconsistent with the above mentioned criteria, remove and replace at no additional cost to the Owner.
3. Install ducts with fewest possible joints.
4. Install fabricated fittings for changes in directions, size, shape, and for connections.
5. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12-inches, with a minimum of 3 screws in each coupling.
6. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
7. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
8. Install ducts with a clearance of 1-inch, plus allowance for insulation thickness. Allow for easy removal of ceiling tile.
9. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
10. Coordinate layout with suspended ceiling, air duct accessories, lighting layouts, and similar finish work.
11. Electrical and IT Equipment Spaces: route ducts to avoid passing through transformer vaults, electrical equipment spaces, IDF/MPOE rooms, and enclosures.
12. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2-inches.
13. Fire- and Smoke-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire, smoke or combination fire and smoke dampers as governed by Building Code and AHJ, including sleeves, and firestopping sealant.

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14. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Reference Mason Seismic Restraint and Support Systems.
15. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's Duct Cleanliness for New Construction Advanced Level.
16. Paint interiors of metal ducts, that do not have duct liner, for 24-inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible duct material.
17. Install ductwork in the location and manner shown and detailed. Review deviations required by job conditions with Architect prior to any fabrication. Provide fittings for construction per SMACNA.
18. Install flexible ductwork to limit sag between support hangers to 1/2-inch per foot of spacing support.

C. Flanged Take-Offs:

1. Install at branch takeoffs to outlets using round or flex duct.
2. Flanged take-offs secured with minimum 8-inch screw spacing (three screws minimum).
3. Provide ductwork taps and branches off of main ducts at 45 degrees whether shown on Drawings or not (drawings are diagrammatic).

D. Cleaning:

1. 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.
2. Grille and Exposed Duct Cleaning:
 - a. After completion of ductwork installation, operate each fan system (excluding exhaust fans) for a minimum of 30 minutes prior to installation of ceiling grilles and diffusers. After grilles and diffusers are installed, clean out accumulation of particles from grilles and diffusers prior to acceptance.
 - b. Clean exterior surface of ducts exposed to public view of chalk, pencil and pen marks, labels, sizing tags, dirt, dust, etc., so that upon completion of installation, ducts are left in clean and unblemished manufactured conditions.
 - c. Exposed duct and grilles to remain free of dust entrained streaks due to leakage at joints and grille connections during warranty period. Clean leaks, seal and refinish to match existing if visible streaks develop.

3.2 DUCTWORK, JOINTS AND FITTINGS INSTALLATION

A. Duct Materials - Applied Locations:

1. General: Use the following materials in design of ductwork specified in this Section unless otherwise noted on the Drawings.

Location or Application	Material
Supply, Return, Transfer, and Exhaust - Low Pressure (downstream of terminal units)	Single Wall, Galvanized Steel
Supply, Return, and Exhaust - Medium Pressure (upstream of terminal units)	Single Wall, Galvanized Steel

B. Ductwork Installation:

1. Fabricate radius elbows with centerline radius not less than 1-1/2 duct diameters.
2. Do not install duct size transition pitch angles which exceed 30 degrees for reductions in duct size in the direction of airflow, and 15 degrees for expansions in duct size in the direction of airflow.
3. Install fixed turning vanes in square throat rectangular elbows and in tees.
4. Fabricate duct turns with the inside (smallest) radius at least equal to the duct width (supply ducts) and 1.5 times radius (return and exhaust ducts). Where necessary, square elbows may be used, with maximum available inside radius and with fixed turning vanes. In healthcare settings such as hospitals and medical office buildings, square elbows and turning vanes allowed on supply ductwork only.

3.3 INSULATED FLEXIBLE DUCT INSTALLATION

- A. Provide sheet metal plenum or rigid elbow and connect to diffusers and grilles with ductwork connections. Refer to Drawings for more information. Provide straight section of flexible duct with minimum length of 2-feet and maximum length of 5-feet and connect to sheet metal plenums and rigid elbows connected to diffusers and grilles, unless noted otherwise.
1. Provide round neck grilles/diffusers or square-to-round transitions. Flexible duct connections directly to diffuser and grilles is not allowed.
 2. Flexible duct allowed in concealed spaces above lay-in ceilings only.

3.4 DRAIN PANS INSTALLATION

- A. Install where shown on Drawings. Drain provided by Division 22, Plumbing. Provide drain (sized per code) connection from each drain pan and pipe to nearest floor drain through trap and 10-inch air gap. Drain pans over 6-feet in length require drain connections from both ends. Pitch drain pans in direction of air flow and to drain. Support secondary drain pan independently from equipment.

3.5 DUCTWORK JOINT SEALERS AND SEALANTS INSTALLATION

- A. Joints and Seam Joint Sealing:
1. Seal duct seams and joints according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, for duct pressure class indicated.
 2. Seal transverse joints, longitudinal seams and duct wall penetrations including screw, fastener, pipe, rod, and wire.

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3. Seal ducts before external insulation is applied.
4. Tape joints of PVC coated metal ductwork with PVC tape.
5. Fasteners such as sheet-metal screws, machine screws or rivets to be cadmium plated.
6. Rectangular Ductwork: Where intermediate joint reinforcement is required for duct of negative pressure class, pre-drill stiffening flange and provide fastener maximum 8-inches on center. Where retaining flanges are welded to duct wall, paint welds with zinc coating.
7. Single Wall Round Ductwork: Joint to incorporate beaded slip collar with minimum #8 sheet metal screws 8-inches on center. Seal ductwork as specified in this Section.
8. Seal joints and seams. Apply sealant to make end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
9. Double Wall Round Ductwork: Joint to incorporate beaded slip collar or flanged connection, with minimum #8 sheet metal screws 8-inches on center. Seal ductwork as specified in this Section.
10. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
11. Provide openings in ductwork where required to accommodate thermometers and control devices. Provide pitot 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.
12. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities as well as Code required clearances.

END OF SECTION

SECTION 23 3300
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Sheet Metal Materials
2. Backdraft Dampers
3. Dampers
4. Concealed Damper Hardware
5. Access Doors
6. Duct Test Holes
7. Turning Vanes
8. Flexible Connectors

1.2 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Manufacturer's catalog data and fabrication/installation drawings for each factory fabricated duct accessory. Include leakage, pressure drop and maximum back pressure data.
2. Shop Drawings: Indicate air duct accessories.
3. Manufacturer's installation instructions: Provide instructions for each factory fabricated duct accessory.
4. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - a. See Division 01, General Requirements, Product Requirements for additional provisions.

- b. Extra Fusible Links: One of each type and size.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this Section, with minimum five years of documented experience.
 2. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
 3. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
 4. AMCA 511 - Certified Ratings Program for Air Control Devices.
 5. AMCA 611, latest edition - Certified Ratings Program - Product Rating Manual for Airflow Measurement Stations.
 6. AMCA 610, latest edition - Laboratory Methods of Testing Airflow Measurement Stations for Performance Rating.
 7. CSFM - California State Fire Marshal Listing for Fire Damper and Smoke Damper.
 8. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
 9. NFPA 92A - Smoke-Control Systems.
 10. NFPA 92B - Smoke Control Systems in Atria, Covered Malls and Large Areas.
 11. NFPA 101 - Life Safety Code.
 12. UL 555 - Standard for Safety; Fire Dampers.
 13. UL 555S - Standard for Safety; Leakage Rated Dampers for Use in Smoke Control Systems.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M. Galvanizing: 1-1/4 ounces per square foot total both sides; ducts to have mill-phosphatized

finish for surfaces exposed to view.

- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36-inches or less; 3/8-inch minimum diameter for lengths longer than 36-inches.

2.2 BACKDRAFT DAMPERS

- A. Manufacturers:
 - 1. Air Balance
 - 2. Cesco
 - 3. Greenheck
 - 4. Nailor
 - 5. Ruskin
- B. Basis-of-Design: Ruskin CB D6.
- C. Description: Multiple-blade gravity balanced with center pivoted blades with sealed edges, assembled in rattle free manner with 90-degree stop, adjustment device to permit setting for varying differential static pressure.
- D. Frame: 0.125-inch thick 6063-T5 extruded aluminum channel with galvanized steel braces at mitered corners. Provide mounting flange.
- E. Blades: Single piece, overlap frame, parallel action, horizontal orientation, minimum 0.07-inch 6063-T5 extruded aluminum material, maximum 6-inch width.
- F. Bearings: Corrosion-resistant synthetic, formed as single piece with axles.
- G. Blade Seals: Extruded vinyl, mechanically attached to blade edge.
- H. Blade Axles: Corrosion-resistant, synthetic formed as single piece with bearings, locked to blade.
- I. Tie Bars and Brackets: Galvanized steel.
- J. Return Spring: Adjustable tension.
- K. Damper Capacity:
 - 1. Closed Position: Maximum back pressure of 16-inches water gauge.
 - 2. Open Position: Maximum air velocity of 2,500-feet per minute.
- L. Counterbalances: Adjustable zinc plated steel weights mechanically attached to blade. Must be capable of operating over wide range of pressures.
- M. Finish: Mill aluminum.

- N. Temperature Rating: -40 degrees F to 200 degrees F.
- O. Operation of Blade:
 - 1. Start to Open: 0.01-inch wg
 - 2. Fully Open: 0.05-inch.
- P. Pressure Drop: Maximum 0.15-inch wg at 1,500-feet per minute through 24-inch by 24-inch damper.
- Q. Factory Sleeve: Minimum 20 gauge thickness, 12-inches in length.
- R. Screen: At outdoor intake or discharge. 1/4-inch aluminum.

2.3 DAMPERS

- A. Manufacturers:
 - 1. Air Balance
 - 2. Cesco
 - 3. Greenheck
 - 4. Nailor
 - 5. Ruskin
- B. Basis-of-Design:
 - 1. Rectangular ductwork for velocities and pressures up to 1,500 fpm and 2.5-inch wg, respectively: Ruskin MD-35.
 - 2. Rectangular ductwork for velocities and pressures up to 3,000 fpm and 4-inch wg, respectively: Ruskin CD-60.
 - 3. Round ductwork for velocities and pressures up to 3,000 fpm and 4-inch wg, respectively: Ruskin CDSR-15.
- C. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
 - 1. Pressure Classes of 3-Inch wg (750 Pa) or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.
- D. Rectangular Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design with linkage concealed in frame and suitable for horizontal or vertical applications.
 - 1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum 16 gauge thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.

- a. Roll-Formed Steel Blades: Galvanized sheet steel, 16 gauge thick for velocities up to 1,500 fpm, and 14 gauge thick for velocities up to 3,000 fpm.
 - b. Blade Axles: Minimum 1/2-inch diameter, plated steel, hex shaped, mechanically attached to blade.
 - c. Bearings: Molded synthetic sleeve, turning in extruded hole in frame.
 - d. Tie Bars and Brackets: Galvanized steel.
 - e. Mill galvanized.
- E. Round Volume Dampers: Single-blade suitable for horizontal or vertical applications.
- 1. Steel Frames: Galvanized, roll formed, minimum of 20 gauge thick with beads at each end.
 - 2. Blades: Minimum 14 gauge thick, galvanized sheet steel, round, single-piece.
 - 3. Blade Axles: Minimum 1/2-inch square, plated steel, mechanically attached to blade.
 - 4. Bearings: Molded synthetic sleeve, turning in hole in frame.
 - 5. Finish: Mill galvanized.
 - 6. Capacity:
 - a. Closed Position: Maximum pressure of 4-inches wg.
 - b. Open Position: Maximum air velocity of 3,000-feet per minute.
 - 7. Leakage: Maximum 20 cfm at 4-inches wg.
 - 8. Pressure Drop: Maximum 0.02-inch wg at 1,500-feet per minute through 20-inch diameter dampers.
- F. Jackshaft: 1-inch diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
- 1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.
 - 2. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include 2-inch elevated platform for insulated duct mounting.

2.4 CONCEALED DAMPER HARDWARE

- A. Manufacturers:
 - 1. Young Regulator Company
- B. Concealed Damper Hardware: For dampers above non-removable ceilings (gyp, plaster, decorative, etc.) where access panels have not been shown on Architectural drawings or in locations where dampers are more than 2-feet above the ceiling, provide:

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1. Concealed Damper Regulator: Young Regulator Company Model 315 or approved equivalent.
2. Cable System: Young Regulator Company or approved equivalent.
3. Controller: Young Regulator Company 270-275 or approved equivalent.
4. Control wrenches, wire stops, casing nuts, and stainless steel wire.
5. Paint cover plate to match ceiling color or as directed by Architect.

2.5 ACCESS DOORS

- A. Manufacturers:
 1. Ductmate
 2. Cesco
 3. Ruskin
 4. Nailor
 5. Outdoor Installation: Karp MX insulated exterior access door.
- B. Duct Pressure Class 2-inch WC and Greater: Sandwich-type design with threaded locking bolt assembly. Closed cell neoprene gasket permanently bonded to inside panel. Zinc-coated steel wing nuts or polypropylene molded knobs with threaded metal inserts - zinc coated bolts sealed to inner panel.
- C. Duct Pressure Class 1-1/2-inch WC and Less: Galvanized steel assembly incorporating frame, door, hinges, and latch(es). Frame tabbed for attachment to duct panel. Double wall door panel with 1-inch insulation. Open cell neoprene gasket attached to frame. Cam latches for tight closure.
- D. Plenum Doors: Extruded aluminum frames with extruded santoprene seals. Double-wall 20 gauge galvanized steel door panel with fiberglass insulation.
- E. Size: Maximum size available to fit rectangular duct panel dimension or round duct diameter. Plenum doors minimum 2-feet wide by 4-feet high.
- F. For outdoor installation, only provide waterproof access doors installed vertically.

2.6 DUCT TEST HOLES

- A. Manufacturers:
 1. Ventlok
- B. Temporary Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.
- C. Permanent Test Holes (where shown on Drawings): Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

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2.7 TURNING VANES

- A. Manufacturers:
 - 1. Aerodyne
 - 2. Ductmate Industries
 - 3. Duro Dyno Corp.
 - 4. Metalaire Inc.
- B. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners to automatically align vanes.
- C. Manufactured Turning Vanes: For medium pressure ductwork, ductwork upstream of terminal units, and in ductwork with equal inlet width and height dimensions and outlet width and height dimension, provide double thickness airfoil turning vanes. Low pressure ductwork and ductwork downstream of terminal units use either single thickness or double thickness turning vanes. For mitered rectangular elbows with changes in size from inlet to outlet, only use single thickness turning vanes. Use 2-inch radius vanes spaced on centers of 1.5-inches for single thickness. Use 2-inch radius vanes spaced on centers of 2.125-inches for double thickness.
- D. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.8 FLEXIBLE CONNECTORS

- A. Manufacturers:
 - 1. Duro Dyne Corp.
 - 2. Ventfabrics Inc.
 - 3. Ductmate Industries
 - 4. Hardcast
- B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- C. Metal-Edged Connectors: Factory fabricated with a fabric strip 4-inches wide attached to two strips of 2-3/4-inch wide, 0.028-inch thick, galvanized sheet steel or 0.032-inch thick aluminum sheets. Select metal compatible with ducts.
- D. Provide a spring and bracket assembly to reinforce the fabric with sufficient tension to prevent connector collapse under negative or positive pressure. Number and positioning of spring-link fixture to be determined by the manufacturer to maintain straight axis and without kinks between two sections of duct, or between duct and the moving element. Hardcast Spring-Link SL-200, or equal.
- E. Indoor System, Flexible Connector Fabric (FC-I): Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 30 ounces per square yard.

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2. Tensile Strength: 395 pounds of force per inch in the warp and 255 pounds of force per inch in the filling.
3. Service Temperature: -40 degrees F to 200 degrees F.

PART 3 - EXECUTION

3.1 DUCT ACCESSORIES GENERAL INSTALLATION

- A. Inspect areas to receive air duct accessories. Notify Engineer of conditions that would adversely affect the installation of the dampers. Do not proceed until conditions are corrected.
- B. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.
- C. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- D. Do not compress or stretch damper frames into duct or opening.
- E. Handle dampers using sleeve or frame. Do not lift dampers using blades, actuators, or jack shafts.
- F. Adjust duct accessories for proper settings.

3.2 SHEET METAL MATERIALS INSTALLATION

- A. Install bracing for multiple sections to support assembly weights and hold against system pressure. Install bracing as needed.

3.3 BACKDRAFT DAMPERS INSTALLATION

- A. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated. Provide at outside air intakes where motorized dampers are not shown on drawings.

3.4 DAMPERS INSTALLATION

- A. Where installing volume dampers in ducts with liner, avoid damage to and erosion of duct liner.
- B. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts for air balancing. Install at a minimum of two duct widths from each branch takeoff. Provide balancing dampers for all air inlets and outlets.
- C. Install dampers square and free from racking with blade running horizontally.

3.5 CONCEALED DAMPER HARDWARE INSTALLATION

- A. Coordinate location in Reflected Ceiling Plan and color of concealed damper hardware with Architect prior to installation.

3.6 ACCESS DOORS INSTALLATION

- A. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:

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1. On both sides of duct coils.
2. Downstream from volume dampers, turning vanes and equipment.
3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.
4. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot (15-m) spacing.
5. Install the following sizes for duct-mounting, rectangular access doors:
 - a. One-Hand or Inspection Access: 8-inches by 5-inches.
 - b. Two-Hand Access: 12-inches by 6-inches.
 - c. Head and Hand Access: 18-inches by 10-inches.
 - d. Head and Shoulders Access: 21-inches by 14-inches.
 - e. Body Access: 25-inches by 14-inches.
 - f. Body Plus Ladder Access: 25-inches by 17-inches.
6. Install the following sizes for duct-mounting, round access doors:
 - a. One-Hand or Inspection Access: 8-inches in diameter.
 - b. Two-Hand Access: 10-inches in diameter.
 - c. Head and Hand Access: 12-inches in diameter.
 - d. Head and Shoulders Access: 18-inches in diameter.
 - e. Body Access: 24-inches in diameter.
7. Label access doors.

3.7 DUCT TEST HOLES INSTALLATION

- A. Provide test holes at fan inlets and outlets where indicated and where required for air testing and balancing.

3.8 TURNING VANES INSTALLATION

- A. Vanes must be installed, eliminating every other vane is not allowed.
- B. Single thickness vanes cannot be over 36-inches long without intermediate vane runner.
- C. Install per SMACNA and fasten/support to prevent vibration, noise, and to maintain proper alignment at design velocity.

3.9 FLEXIBLE CONNECTORS INSTALLATION

- A. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators. Provide sheet metal weather cover over

flexible connections located outdoors. Attach sheet metal to either equipment side or ductwork side, but not both.

- B. Per NFPA, do not use flexible connectors on grease exhaust fans.
- C. Securely attach spring-lock brackets to the metal strips of the connector collar using No. 8 sheet metal screws.
- D. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- E. Adjust the following types in the following locations:
 - 1. FC-I: Indoors.

END OF SECTION

SECTION 23 3400
HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Centrifugal Fans
2. Ceiling Exhaust Fans
3. In-Line Centrifugal Fans

1.2 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material gauges and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Motors: Premium efficiency per Section 23 05 13, Common Motor Requirements for HVAC Equipment. Electrically Commutated Motors (ECM) where scheduled on Drawings.
2. Sound power levels as scheduled on Drawings. If not scheduled, within 5 percent of Basis of Design at design flow.

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3. Project Altitude: Base air ratings on sea-level conditions for project sites below 2,000 feet in elevation. Base air ratings on actual site elevations for project sites above 2,000 feet in elevation.
4. Operating Limits: Classify according to AMCA 99.
5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
6. AMCA Compliance: Products are to comply with performance requirements and are to be licensed to use the AMCA-Certified Ratings Seal.
7. NEMA Compliance: Motors and electrical accessories are to comply with NEMA standards.
8. UL Standard: HVAC Fans are to comply with UL 705. Fans used in grease exhaust applications are to be UL 762 listed for grease exhaust.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

1.8 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Belts: One set for each belt-driven unit.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL FANS

- A. Manufacturers:
 1. Greenheck

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2. Cook
 3. Twin City
- B. Description: Centrifugal or utility type centrifugal fans, as indicated, standard factory finish, AMCA rated, single width, single inlet, double width, double inlet, forward curved, backward inclined, or airfoil blades as scheduled.
- C. Wheel and Inlet:
1. Backward Inclined: Steel or aluminum construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded or riveted to flange and back plate; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.
 2. Airfoil Wheel: Steel construction with smooth curved inlet flange, heavy back plate die formed hollow airfoil shaped blades continuously welded at tip flange, and back plate; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.
 3. Statically and dynamically balance wheel within its own bearings with maximum balance quality grade at bearings of G16 (0.20 in/sec peak velocity, filter-in as measured at fan RPM) for 5 hp and below and G6.3 (0.15 in/sec peak velocity, filter-in as measured at fan RPM) for 7.5 hp and above per ANSI S2.19. AMCA 210 rated.
- D. Housing:
1. Heavy gauge steel, spot welded for AMCA 99 Class I and II fans, and continuously welded for Class III, adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut.
 2. Finish: Factory finish to manufacturer's standard (Permatector) or Factory finish to manufacturer's standard with Hi-Pro polyester finish exceeding 1,000 hours of salt spray under ASTM B117 test method. For fans handling air downstream of humidifiers, provide two additional coats of paint or fabricate of galvanized steel. Prime coating of aluminum parts is not allowed.
 3. Removable angles and bolts for attaching flexible connections and discharge dampers on fan outlet.
 4. Housing Discharge Arrangement: Adjustable to eight standard positions.
- E. Bearings and Drives:
1. Bearings: Heavy duty pillow block type, self-greasing ball bearings, with ABMA 9 L-10 life at 100,000 hours.
 2. Shafts: Hot rolled steel, ground and polished, with keyway, protectively coated with lubricating oil, and shaft guard. Provide anti-corrosive coating.
 3. Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 5 hp and under, selected so required rpm is obtained with sheaves set at mid-position fixed sheave for 7.5 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of motor.

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4. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 5. Belt Guard: Fabricate to SMACNA Duct Construction Standards - Metal and Flexible; 0.106-inch thick, 3/4-inch diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
- F. Motor: Integrally mounted, 1800 RPM maximum, with pre-lubricated sealed ball bearings. ODP for motors located indoors and TEFC for motors exposed to moisture.
- G. Accessories:
1. Inlet/Outlet Screens: Galvanized steel welded grid, removable, at unit outlet for outdoor installation, and unit inlet for unducted conditions.
 2. Access Doors: Shaped to conform to scroll, with quick opening latch type handles and gaskets.
 3. Scroll Drain: 1/2-inch steel pipe coupling welded to low point of fan scroll for outdoor installation.
 4. AMCA 99 Type B spark proof construction where scheduled.
 5. Protective coating on fan wheel and interior of fan housing where scheduled. Apply coating before balancing fans and repair any breaks in coating which occur during balancing. One 6-mil coat of white plastic #7122 and one 6-mil coat of black plastic #7122.
 6. Vibration isolation as scheduled and specified. Reference Section 23 05 48, Vibration and Seismic Controls for HVAC Piping and Equipment.

2.2 CEILING EXHAUST FANS

- A. Manufacturers:
1. Greenheck
 2. Cook
 3. Broan
 4. Twin City
 5. Panasonic
- B. Description: Centrifugal fan, direct drive, cabinet and exhaust grille. AMCA rated. Sound level as scheduled. Fan shrouds, motor, and fan wheel are to be removable for service.
- C. Wheel: Double width, double inlet, forward curved blades:
- D. Housing: Acoustically insulated steel casing, factory standard finish, bottom access through grille, ducted outlet, egg crate inlet grille. Provide stainless steel grille where scheduled.

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- E. Drives: Direct drive.
- F. Back draft damper.
- G. Accessories:
 - 1. Disconnect plug.
 - 2. Flat roof cap.
 - 3. Hooded wall cap.
 - 4. Pitched roof cap.
 - 5. Elbow discharge with grille.
 - 6. Louvered wall discharge with bird screen.
- H. Motor: Integrally mounted with pre-lubricated sealed ball bearings. Engineered and rated to run continuously.
 - 1. Variable-Speed Controller: Where scheduled on Drawings, provide solid-state control to reduce speed from 100 percent to less than 50 percent.
 - 2. Disconnect Switch: Where not shown on Division 26, Electrical Drawings, provide nonfusible type, with thermal-overload protection mounted inside fan housing factory wired through an internal aluminum conduit.
 - 3. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
 - 4. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
 - 5. Motion Sensor: Motion detector with adjustable shutoff timer.
 - 6. Electrically Commutated Motor (ECM) where indicated on Fan Schedule on Drawings.
- I. Filter: Washable aluminum to fit between fan and grille.
- J. Isolation: Rubber-in-shear vibration isolators.

2.3 IN-LINE CENTRIFUGAL FANS

- A. Manufacturers:
 - 1. Greenheck
 - 2. Cook
 - 3. Twin City
- B. Description: In-line centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.
- C. Wheel: Cast aluminum backward inclined with inlet cone statically and dynamically balanced within its own bearings.

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D. Housing:

1. Heavy gauge steel or aluminum housing, suitable for Fan Class, factory standard finish.
2. Removable panels for access to all interior components.
3. Horizontal or vertical configuration, as indicated.
4. Inlet and discharge duct collars.
5. 1-inch thick, 1.5 pounds per cubic foot density fiberglass liner.
6. Aluminum straightening vanes.
7. Support bracket adaptable to floor, sidewall, or ceiling mounting.

E. Bearings and Drives:

1. Bearings: Heavy duty pillow block type, self greasing ball bearings with ABMA 9 life at 50,000 hours.
2. Shafts: Hot rolled steel, ground and polished, with keyway, protectively coated with lubricating oil.
3. Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 5 hp and under, selected so required rpm is obtained with sheaves set at mid-position. Fixed sheave for 7.5 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of motor. Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
 - a. Inverter duty motor for use with variable frequency drive where indicated on Fan Schedule on Drawings.
4. Drive: Direct drive matched to fan loads with speed controller. Motor encased in housing outside of airstream, factory wired to disconnect switch located on outside of fan housing.
 - a. Electrically Commutated Motor (ECM) where indicated on Fan Schedule on Drawings.

F. Accessories:

1. Belt guard.
2. AMCA 99 Type B spark proof construction where scheduled.
3. Variable-Speed Controller: Provide solid-state control to reduce speed from 100 percent to less than 50 percent for motors 1/2 HP or smaller.
4. Discharge Dampers: Parallel blade for mixing or open/close applications and opposed blade for modulating. Heavy duty steel or aluminum, where scheduled. Damper assembly with blades constructed of two plates formed around and welded to shaft, channel frame, sealed ball bearings, with blades linked out of air stream to single control

- lever. Motorized where indicated and gravity actuated with counterweight, where motorized is not indicated.
5. Flat roof cap.
 6. Hooded wall cap.
 7. Pitched roof cap.
 8. Elbow discharge with grille.
 9. Louvered wall discharge with bird screen.
- G. Inlet/Outlet Screens: Galvanized steel welded grid, removable.
- H. Vibration Isolation: Wheel and motor mounted on integral double deflection neoprene isolators.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Install in accordance with manufacturer's instructions.
- B. Install power ventilators level and plumb.
- C. Fans used for exhaust of kitchen grease hoods are to be UL 762 listed for grease exhaust. Provide fans with grease terminator. Pipe from grease terminator to Code approved location.
- D. Fans used for exhaust of moist air are to be constructed of aluminum construction and be warranted for their application in moist conditions.
- E. Fans used in welding, chemical, and/or fume exhaust applications are to be of spark-proof construction and are to be protected with coatings as required to protect parts in the air stream from the chemicals and materials the fan will be exposed to.
- F. Install floor-mounting units on concrete bases.
- G. Units using vibration isolation devices are scheduled on Drawings.
- H. Support suspended units from structure threaded steel rods and vibration isolation device scheduled on Drawings.
- I. In seismic zones, restrain support units.
- J. Install units with clearances for service and maintenance.
- K. Provide fixed sheaves required for final air balance.
- L. Provide safety screen where inlet or outlet is exposed.
- M. Pipe scroll drains to nearest floor drain.
- N. Provide backdraft dampers on discharge of exhaust fans and as indicated on Drawings.

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- O. Duct installation and connection requirements are specified in other Division 23, HVAC Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors per Section 23 33 00, Air Duct Accessories.
- P. Install ducts adjacent to power ventilators to allow service and maintenance.
- Q. Ground equipment.
- R. 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 and UL 486B.
- S. Equipment Startup Checks:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Verify lubrication from bearings and other moving parts.
 - 6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 7. Disable automatic temperature-control operators.
- T. Starting Procedures:
 - 1. Energize motor and adjust fan to indicated rpm.
 - 2. Measure and record voltage and amperage.
- U. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
- V. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- W. Shut unit down and reconnect automatic temperature-control operators.
- X. Replace fan and motor pulleys as required to achieve design airflow.
- Y. Provide totally enclosed fan cooled motors when motor is located outdoors, whether under a cover or not, or exposed to moisture. Provide protective covering for electronically commutated motors located in outdoor or wet/wash-down locations.

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- Z. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.
- AA. Adjust damper linkages for proper damper operation.
- BB. Adjust belt tension.
- CC. Lubricate bearings.
- DD. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.
- EE. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.
- FF. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC fans. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.

3.2 CEILING EXHAUST FANS

- A. Suspend units from structure; use steel wire or metal straps.

END OF SECTION

SECTION 23 6201
VARIABLE REFRIGERANT FLOW_VOLUME (VRF_VRV) SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Outdoor Unit (Non-Heat Recovery)
 - 2. Indoor Unit - Ceiling Cassette (Four-Way)
 - 3. Controls for VRV Systems
- B. Variable capacity, heat pump air conditioning system.
- C. System consists of an outdoor unit, branch circuit terminal or branch selector units, multiple indoor fan units and PID DDC (Direct Digital Controls). Each indoor unit or group of indoor units capable of operating in any mode independently of other indoor units or groups. System capable of changing mode (cooling to heating, heating to cooling) with no interruption to system operation. Each indoor unit or group of indoor units independently controlled. Sum of connected capacity of indoor air handlers range from 50 percent to 130 percent of outdoor rated capacity.
- D. Variable capacity heat pump system (non-heat recovery) system consist of outdoor unit, multiple indoor units and PID DDC (Direct Digital Controls). Sum of connected capacity of indoor air handlers range from 50 percent to 130 percent of outdoor rated capacity. Heating mode or cooling mode/no simultaneous operation.

1.2 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Facility manufacturing registered to ISO 9001 and ISO 14001.
 - 2. Full charge of R-410A provided in condensing unit from factory.
 - 3. Units to be listed by Electrical Laboratories (ETL) and bear the ETL label.

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4. Wiring in accordance with the National Electric Code (NEC).
5. The system will bear the Energy Star label.
6. The installing contractor to receive instruction and training from the equipment manufacturer prior to installation. Instruction to cover manufacturer's recommended methods for piping, wiring, leak testing, etc. Documentation of the training is to be provided to the Architect for review.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 1. Five year warranty on compressor(s).

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Daikin (latest series).
- B. Trane/Mitsubishi (latest series).
- C. LG (latest series).
- D. Samsung (latest series).
- E. Approved Alternate Manufacturer: Drawings indicate Basis of Design manufacturer, alternate acceptable manufacturers listed may be provided, meeting capacities of Basis of Design system. Each alternate manufacturer has a specific refrigerant distribution system that is proprietary. Therefore, alternate proposed systems are to include the cost of refrigerant distribution modifications, equipment location modification, condensate and secondary condensate over flow modifications, electrical modifications, architectural modifications, structural modifications, maintenance and access modifications, and other modifications required to submit the manufacturer that is not the Basis of Design.

2.2 OUTDOOR UNIT (NON-HEAT RECOVERY)

- A. General:
 1. Outdoor unit with manufacturer components. Multiple circuit boards that interface to controls system to perform functions necessary for operation. Factory assembled, piped, wired and run tested.
 2. Outdoor unit will have a sound rating no higher than 60 dB(A) individually or 65 dB(A) twinned. Units to have a sound rating no higher than 50 dB(A) individually or 55 dB(A) twinned while in night mode operation.
 3. Refrigerant lines from outdoor unit to indoor units insulated.
 4. Outdoor unit have an accumulator with refrigerant level sensors and controls.

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5. Outdoor unit have a high pressure safety switch, over-current protection and DC bus protection.
6. Heating mode operation down to minus 0 degrees F ambient temperature or cooling mode down to 23 degrees F ambient temperature, without additional low ambient controls.
7. High efficiency oil separator plus additional logic controls to maintain adequate oil volume in compressor.
8. The system will automatically restart operation after a power failure and will not cause any settings to be lost. System not to require re-programming in the event of power failure.
9. The outdoor unit to be modular in design and to allow for side-by-side installation following manufacturer's recommended clearances.

B. Unit Cabinet:

1. Casings to be completely weatherproof and fabricated of galvanized steel, bonderized and finished. Withstand 960 hours per ASTM B117 criteria for seacoast protected models.

C. Fan:

1. Direct drive, variable speed propeller type fan.
2. Fan motor inherent protection, permanently lubricated bearings, and completely variable speed operation via a DC inverter.
3. Fan factory set for operation under 0-inch WG external static pressure, but capable of normal operation under a maximum of 0.24-inch WG external static pressure via dipswitch.
4. Fan motor mounted for quiet operation.
5. Raised guard to prevent contact with moving parts.
6. Outdoor unit to have horizontal discharge airflow.

D. Refrigerant:

1. R410A refrigerant.

E. Outdoor Coil:

1. Nonferrous construction with lanced or corrugated plate fins on copper tubing.
2. Factory applied corrosion resistant finish.
3. Integral metal coil guard.
4. Inverter driven compressor refrigerant flow control.

F. Compressor:

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1. Inverter driven scroll hermetic compressor.
2. Crankcase heater.
3. Outdoor unit compressor have inverter to modulate capacity. Variable capacity turndown of 18-4 percent of rated capacity, depending upon unit size.
4. Internal thermal overload.
5. The compressor(s) to be mounted on rubber-in-shear isolators to avoid the transmission of vibration.

G. Electrical:

1. The power supply to the outdoor unit to be as scheduled on the drawings.
2. The control voltage between the indoor and outdoor unit to be 16 VDC or 24 VDC non-shielded 2 conductor cable.
3. The control wiring to be a two-wire multiplex transmission system, connecting multiple indoor units to one outdoor unit with a single 2-cable wire.

2.3 INDOOR UNIT - CEILING CASSETTE (FOUR-WAY)

A. General:

1. Four-way cassette style indoor unit, recesses into ceiling with ceiling grille matched to outdoor unit.
2. Factory assembled, wired and run tested. Factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. Self-diagnostic function, 3-minute time delay mechanism, auto restart function, emergency operation function, test run switch, and ability to adjust airflow patterns for different ceiling heights.
3. Indoor unit and refrigerant pipes precharged with dehydrated air before shipment from factory.

B. Unit Cabinet:

1. Space-saving ceiling-recessed cassette.
2. Provisions for field installed filtered outside air intake.
3. Branch ducting allowed from cabinet.
4. Four-way grille fixed to bottom of cabinet allowing two-, three- or four-way blow.
5. Grille vane angles individually adjustable from wired remote controller to customize airflow pattern.

C. Fan:

1. Indoor fan assembly with direct driven, single motor fan.
2. Minimum two speed settings.

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3. Five speed settings; Low, Mid1, Mid2, High and Auto.
 4. Sensor measures room temperature variations and adjusts airflow for even space conditioning.
- D. Filter:
1. Long-life washable return air filter
- E. Evaporator Coil:
1. Nonferrous construction with smooth plate fins on copper tubing with inner grooves for high efficiency heat exchange.
 2. Brazed joints with phos-copper or silver alloy.
 3. Pressure tested at factory.
 4. Condensate pan and drain under coil. Provide with integral condensate pump.
 5. Integral condensate lift mechanism to raise drain water minimum 21-inches above condensate pan.
 6. Insulated refrigerant lines.
- F. Controls:
1. The unit to have PID controls provided by manufacturer to perform input functions necessary to operate the system. No third party building management system to be required, however, VRV/VRF system to be capable of communicating with third party BMS.
 2. The unit to be compatible with interfacing with connection to LonWorks or BACnet networks.

2.4 CONTROLS FOR VRV SYSTEMS

- A. General:
1. General Electrical: 24 VDC controller power and communications via common, non-polar communications bus: Main system controller capable of being networked with other system controllers for web based control.
 2. Wiring type: Wiring 2-conductor (16 AWG), twisted shielded pair, and stranded wire.
- B. Controls Network:
1. Controls Network consists of remote controllers, schedule timers, system controllers, centralized controllers, and integrated web based interface communicating over high-speed communication bus. Controls network support operation monitoring, scheduling, error email distribution, personal browsers, tenant billing, online maintenance support, and integration with Building Management Systems. Provide interfaces to support communication protocols specified in Section 23 09 00.

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2. Simple Remote Controller: Simple Remote Controller capable of controlling up to a minimum of 12 indoor units (defined as 1 group). Controller supports temperature display selection of Fahrenheit or Celsius. Controller will allow user to change on/off, mode (cool, heat, auto, dry, and fan), temperature setting, and fan speed setting. Controller able to limit set temperature range from Simple remote controller. Room temperature sensed at either Controller or Indoor Unit dependent on indoor unit dipswitch setting. Controller will display a four-digit error code in event of system abnormality/error.

C. System Integration

1. Control system capable of supporting integration with Building Management Systems (BMS) using protocol specified in Section 23 09 00.
2. Operation and monitoring points include, but are not limited to:
 - a. ON/OFF (setting).
 - b. ON/OFF (status).
 - c. Alarm Sign.
 - d. Error Code.
 - e. Operation Mode (setting).
 - f. Operation Mode (status).
 - g. Fan Speed (setting).
 - h. Fan Speed (status).
 - i. Measured Room Temperature.
 - j. Set Room Temperature.
 - k. Filter Limit Sign.
 - l. Filter Limit Sign Reset.
 - m. Remote Control Operation (ON/OFF).
 - n. Remote Control Operation (Operation Mode).
 - o. Remote Control Operation (Set Temperature).
 - p. Electrical Total Power.
 - q. Communication Status.
 - r. System Forced OFF.
 - s. Forced Thermostat OFF (setting).
 - t. Forced Thermostat OFF (status).

- u. Compressor Status.
- v. Indoor Fan Status.
- w. Heater Operation Status.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. General:

1. Install all refrigerant piping and condensate tubing concealed inside wall at all wall mounted units.

B. Insulation:

1. Insulate refrigerant piping, condensate drains, drip pans, and other associated appurtenances.

C. Controls:

1. Wiring: Control wiring install in a system daisy chain configuration per manufacturer's installation instructions.
2. Control wiring for schedule timers, system controllers, and centralized controllers installed in a daisy chain configuration per manufacturer's installation instructions.
3. Control wiring for remote controllers from remote controller to first associated indoor unit then to remaining associate indoor units in a daisy chain configuration per manufacturer's installation instructions.

D. Indoor Units:

1. Connect refrigerant piping to unit, run piping so as not to interfere with access to unit. Install furnished field mounted accessories. Install per manufacturer's requirements and provide accumulator when required due to length of refrigerant piping. Install rigid, level and plumb.
2. Where manufacturer's standard condensate pump does not provide adequate lift, provide condensate pump that will meet lift requirements. Confirm unit shutdown upon failure of condensate pump.
3. Provide vibration isolation as indicated on drawings.
4. Provide condensate drainage from indoor units and branch selection devices. Provide secondary overflow pans and piping to observable location as required for concealed units.

E. Cleaning:

1. Prior to acceptance, thoroughly clean equipment, remove shipping labels and traces of foreign substance. Touch up with factory matching paint on scratched surfaces.

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F. Start-Up:

1. Factory certified service representative to supervise start-up in accordance with manufacturer's instructions.
2. Make final adjustments to assure proper operation of load system. Demonstrate final set up and programming to Owner.
3. Test units in modes of operation and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

3.2 Outdoor Unit (Non-Heat Recovery)

- A. Connect refrigerant piping to unit, run piping so as not to interfere with access to unit. Install furnished field mounted accessories. Install per manufacturer's requirements and provide accumulator when required due to length of refrigerant piping. Install rigid, level and plumb.

- B. Install per manufacturer's written instructions and requirements.

3.3 Indoor Unit - Ceiling Cassette (Four-Way)

- A. Indoor Units:

1. Connect refrigerant piping to unit, run piping so as not to interfere with access to unit. Install furnished field mounted accessories. Install per manufacturer's requirements and provide accumulator when required due to length of refrigerant piping. Install level and plumb.
2. Where manufacturer's standard condensate pump does not provide adequate lift, provide condensate pump that will meet lift requirements. Confirm unit shutdown upon failure of condensate pump.
3. Provide vibration isolation as indicated on drawings.
4. Provide condensate drainage from indoor units and branch selection devices. Provide secondary overflow pans and piping to observable location as required for concealed units.

- B. Install per manufacturer's written instructions and requirements.

3.4 Controls for VRV Systems

- A. Sequence of Operation

1. Occupied Mode Operation: Indoor fan coil units operate to maintain space temperature set point. Enable associated energy recovery ventilators.
2. Unoccupied Mode Operation: Indoor fan coil units operate to maintain unoccupied space temperature set point. Disable associated energy recovery ventilators.

END OF SECTION

SECTION 26 0000
ELECTRICAL BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Work included in 26 00 00, Electrical Basic Requirements applies to Division 26, Electrical work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of electrical systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.
- C. Definitions:
 - 1. Provide: To furnish and install, complete and ready for intended use.
 - 2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
 - 3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
 - 4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.
 - 5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.2 RELATED SECTIONS

- A. Contents of Section applies to Division 26, Electrical Contract Documents.
- B. Related Work:
 - 1. Additional conditions apply to this Division including, but not limited to:
 - a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
 - b. Drawings
 - c. Addenda
 - d. Owner/Architect Agreement

- e. Owner/Contractor Agreement
- f. Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

- A. References and Standards per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, individual Division 26, Electrical Sections and those listed in this Section.
- B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
 - 1. State of California:
 - a. CALGreen - California Green Building Standards Code (CCR, Title 24, Part 11)
 - b. CBC - California Building Code
 - c. CEC - California Electrical Code
 - d. CEC T24 - California Energy Code Title 24
 - e. CFC - California Fire Code
 - f. CMC - California Mechanical Code
 - g. CPC - California Plumbing Code
 - h. CSFM - California State Fire Marshal
- C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
 - 1. ABA - Architectural Barriers Act
 - 2. ADA - Americans with Disabilities Act
 - 3. ANSI - American National Standards Institute
 - 4. APWA - American Public Works Association
 - 5. ASCE - American Society of Civil Engineers
 - 6. ASHRAE Guideline 0, the Commissioning Process
 - 7. ASTM - ASTM International
 - 8. CFR - Code of Federal Regulations
 - 9. EPA - Environmental Protection Agency
 - 10. ETL - Electrical Testing Laboratories
 - 11. FCC - Federal Communications Commission

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12. FM - FM Global
13. IBC - International Building Code
14. IEC - International Electrotechnical Commission
15. IEEE - Institute of Electrical and Electronics Engineers
16. IES - Illuminating Engineering Society
17. ISO - International Organization for Standardization
18. MSS - Manufacturers Standardization Society
19. NEC - National Electric Code
20. NECA - National Electrical Contractors Association
21. NEMA - National Electrical Manufacturers Association
22. NETA - National Electrical Testing Association
23. NFPA - National Fire Protection Association
24. OSHA - Occupational Safety and Health Administration
25. UL - Underwriters Laboratories Inc.

- D. See Division 26, Electrical individual Sections for additional references.

1.4 SUBMITTALS

- A. See Division 01, General Requirements for Submittal Procedures as well as individual Division 26, Electrical Sections.
- B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.
- C. In addition:
 1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
 2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to

- Architect. Deviations will be returned without review.
- a. Provide separate submittals for power system study (per Specification Section 26 05 73) and electrical equipment (for example, switchboards and panelboards).
 - b. Provide separate submittals for lighting control cutsheets, and for lighting control shop drawings.
 3. Product Data: Provide manufacturer's descriptive literature for products specified in Division 26, Electrical Sections.
 4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and drawings.
 - a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
 - b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 26, Electrical specification Sections for specific items required in product data submittal outside of these requirements.
 - c. See Division 26, Electrical individual Sections for additional submittal requirements outside of these requirements.
 5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of these additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
 6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer's comments. Identify Engineer's comments and provide an individual response to each of the Engineer's comments. Cloud changes in the submittals and further identify changes which are in response to Engineer's comments.
 7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-16 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.
 8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 26, Electrical Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals. Electric motors are supplied and installed by Division 23 unless otherwise specified. During shop drawing

- stage of the project, verify correct disconnect sizes, conductor sizes, etc., and bring any discrepancies to the attention of the Mechanical trade. Be responsible for any modifications to electrical equipment or installations as a result of equipment incompatibility discovered after shop drawing review.
9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
 10. Substitutions and Variation from Basis of Design:
 - a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
 - b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.
 11. Shop Drawings: Provide coordinated shop drawings which include physical characteristics of all systems, device layout plans, and control wiring diagrams. Reference individual Division 26, Electrical specification Sections for additional requirements for shop drawings outside of these requirements.
 - a. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.
 12. Samples: Provide samples when requested by individual Sections.
 13. Resubmission Requirements:
 - a. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
 - b. Resubmit for review until review indicates no exception taken or "make corrections as noted".
 14. Operation and Maintenance Manuals, Owner's Instructions:
 - a. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring

servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.

- 1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
 - 2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment.
 - 3) Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
 - 4) Include product certificates of warranties and guarantees.
 - 5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
 - 6) Include commissioning reports.
 - 7) Include copy of startup and test reports specific to each piece of equipment.
 - 8) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.
- b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 26 00 00, Electrical Basic Requirements, Demonstration.
- c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.
15. Record Drawings:
- a. Maintain at site at least one set of drawings for recording "As-constructed" conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements, location of conduit, and location of concealed electrical items. Include items changed by field orders, supplemental instructions, and constructed conditions.

- b. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.
- c. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD Files and drawings upon substantial completion.
- d. See Division 26, Electrical individual Sections for additional items to include in record drawings.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
- B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.
- C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e. distribution equipment, duct banks, light fixtures, etc.) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.
- D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.
- E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
- F. Provide products that are UL listed.

1.6 WARRANTY

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

- A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, plumbing equipment/fixtures, fire sprinklers, plumbing, lights, cable tray and electrical services with architectural and structural requirements, and other trades (including ceiling suspension and tile systems), and provide maintenance access requirements.
Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.
- B. Advise Architect in event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.
- C. Verify in field exact size, location, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.
- D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL approved or have adequate approval or be acceptable by state, county, and city authorities. Equipment/fixture supplier is responsible for obtaining State, County, and City acceptance on equipment/fixtures that are not UL approved or are not listed for installation.
- B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- C. Hazardous Materials:
 1. Comply with local, State of California, and Federal regulations relating to hazardous materials.
 2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
 3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

- A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 26 00 00, Electrical Basic

Requirements and individual Division 26, Electrical Sections.

- B. Install equipment requiring access (i.e., junction boxes, light fixtures, power supplies, motors, etc.) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in passageways, doorways, scuttles or crawlspaces which would impede or block the intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.
- D. Firestopping:
 - 1. Confirm requirements in Division 07, Thermal and Moisture Protection. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 - a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
- E. Plenums:
 - 1. In plenums, provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.
- F. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- G. Provide miscellaneous supports/metals required for installation of equipment and conduit.

3.2 SEISMIC CONTROL

- A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 26 Electrical Sections.
- B. General:
 - 1. Earthquake resistant designs for Electrical (Division 26) equipment and distribution, i.e. power distribution equipment, generators, UPS, etc. to conform to regulations of jurisdiction having authority.
 - 2. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments

provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.

3. Provide stamped shop drawings from licensed Structural Engineer of seismic bracing and seismic movement assemblies for conduit and equipment. Submit shop drawings along with equipment submittals.
4. Provide stamped shop drawings from licensed Structural Engineer of seismic flexible joints for conduit crossing building expansion or seismic joints. Submit shop drawings along with seismic bracing details.
5. Provide means to prohibit excessive motion of electrical equipment during earthquake.

3.3 REVIEW AND OBSERVATION

- A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
 1. Underground conduit installation prior to backfilling.
 2. Prior to covering walls.
 3. Prior to ceiling cover/installation.
 4. When main systems, or portions of, are being tested and ready for inspection by AHJ.
- C. Final Punch:
 1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Electrical Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the electrical systems are ready for final punch.
 2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CONTINUITY OF SERVICE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements in Division 01, General Requirements, comply with individual Division 26, Electrical Sections and the following:
 1. During remodeling or addition to existing structure, while existing structure is occupied, present services to remain intact until new construction, facilities or equipment is installed.
 2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new wiring, and wiring to point of connection.

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3. Coordinate transfer time to new service with Owner. If required, perform transfer during off-peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.
 - a. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.
4. No interruption of services to any part of existing facilities will be permitted without express permission in each instance from Owner. Requests for outages must state specific dates, hours and maximum durations, with outages kept to these specific dates, hours and maximum durations. Obtain written permission from Owner for any interruption of power, lighting or signal circuits and systems.
 - a. Organize work to minimize duration of power interruption.
 - b. Coordinate utility service outages with utility company.

3.5 CUTTING AND PATCHING

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements in Division 01, General Requirements, comply with individual Division 26, Electrical Sections and the following:
1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
 2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
 3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
 4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and/or walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
 5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.6 EQUIPMENT SELECTION AND SERVICEABILITY

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

3.7 DELIVERY, STORAGE AND HANDLING

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Products and/or materials that become damaged due to water, dirt, and/or dust as a result of improper storage and handling to be replaced before installation.
 2. Protect equipment to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
 3. Protect bus duct and similar items until in service.

3.8 DEMONSTRATION

- A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 26, Electrical Sections.
- B. Upon completion of work and adjustment of equipment, test systems and demonstrate to Owner's Authorized Representative, Architect, and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.9 CLEANING

- A. Confirm Cleaning requirements in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Upon completion of installation, thoroughly clean electrical equipment, removing dirt, debris, dust, temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

- A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended

clearances.

- C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- D. Provide miscellaneous supports/metals required for installation of equipment.

3.11 PAINTING

- A. Confirm requirements in Division 01, General Requirements and Division 09, Finishes. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces (i.e., hangers, hanger rods, equipment stands, etc.) with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
 2. In Electrical Room, on roof or other exposed areas, equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
 3. See individual equipment Specifications for other painting.
 4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
 5. Conduit: Clean, primer coat and paint interior/exterior conduit exposed in public areas with two coats paint suitable for metallic surfaces. Color selected by Architect.
 6. Covers: Covers such as manholes, vaults and the like will be furnished with finishes which resist corrosion and rust.

3.12 ACCEPTANCE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
 - a. Cleaning
 - b. Operation and Maintenance Manuals
 - c. Training of Operating Personnel
 - d. Record Drawings
 - e. Warranty and Guaranty Certificates

f. Start-up/Test Document and Commissioning Reports

3.13 FIELD QUALITY CONTROL

- A. Confirm Field Quality Control requirements in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Tests:
 - 1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in operation and maintenance manuals.
 - 2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.14 LETTER OF CONFORMANCE

- A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that Electrical items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

3.15 SALVAGED EQUIPMENT AND RECYCLED MATERIAL

- A. Salvage the following equipment not being reused and return to Owner:
 - 1. Luminaires
 - 2. Panelboards
 - 3. Breakers
- B. Electrical equipment that cannot be salvaged for reuse, sell/give to recycling company. Recycle following excess, removed, or demolished electrical material:
 - 1. Copper or aluminum conductors, buses, and motor/transformer windings.
 - 2. Steel and aluminum from raceways, boxes, enclosures, and housings.
 - 3. Acrylic and glass from luminaire lenses/refractors.
- C. Provide separate on-site storage space for recycled and salvaged material. Clearly label space.
- D. Confirm additional salvaged equipment and recycled materials in the Contract Documents.

END OF SECTION

SECTION 26 0509
EQUIPMENT WIRING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
1. Equipment connections, whether furnished by Owner or other Divisions of the Contract.

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

- B. In addition:

1. Verify mechanical and utilization equipment electrical characteristics with Drawings and equipment submittals prior to ordering equipment. Submit confirmation of this verification as a part of, or addendum to, the electrical product submittals.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements apply to this Section.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials and Equipment for Equipment Wiring: As specified in individual Sections.

2.2 GENERAL

- A. Unless otherwise noted, the following voltage and phase characteristics apply to motors:
1. 3/4 HP and Under: 120 volt, 1 phase.
 2. 1 HP and Less than 5 HP Loads: 208 volt or 480 volt, 3 phase.

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3. 5 HP and Over: 480 volt, 3 phase.
- B. Safety Switches: Provide as required by CEC and as specified in Section 26 28 16, Enclosed Switches and Circuit Breakers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to submittal of product data for electrical distribution equipment, obtain and examine product data and shop drawings for equipment furnished by the Owner and by other trades on the project. Update the schedule of equipment electrical connections accordingly, noting proper ratings for overcurrent devices, fuses, safety disconnect switches, conduit and wiring, and the like. As a minimum, this requirement applies to equipment furnished by Owner and equipment furnished under the following divisions of work under this contract:
 1. Division 8, Openings
 2. Division 11, Equipment
 3. Division 14, Conveying Equipment
 4. Division 21, Fire Suppression
 5. Division 23, HVAC, Heating, Ventilating and Air Conditioning
 6. Division 27, Communications
 7. Division 28, Electronic Safety and Security

3.2 INSTALLATION

- A. Do not install unrelated electrical equipment or wiring on mechanical equipment without prior approval of Engineer.
- B. Provide moisture tight equipment wiring and switches in ducts or plenums used for environmental air.
- C. Connect motor and appliance/utilization equipment complete from panel to motor/equipment as required by code.
- D. Install motor starters and controllers for equipment furnished by others.
- E. Appliance/Utilization Equipment:
 1. Provide appropriate cable and cord cap for final connection unless equipment is provided with same. Provide receptacle configured to receive cord cap.
 2. Verify special purpose outlet NEMA configuration and ampere rating with equipment supplier prior to ordering wiring devices and coverplates.

3.3 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Division 01, General Requirements.

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3.4 SYSTEMS STARTUP

- A. Provide field representative to prepare and start equipment.
 - 1. Test and correct for proper rotation of polyphase motors.
- B. Adjust for proper operation within manufacturer's published tolerances.
- C. Demonstrate proper operation of equipment to Owner's Authorized Representative.

END OF SECTION

SECTION 26 0519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Lugs and Pads
 - 2. Wires and Cables
 - 3. Connectors

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Cable insulation test reports in project closeout documentation.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Lugs and Pads:
 - 1. Anderson
 - 2. Ilsco
 - 3. Panduit

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4. Thomas & Betts
5. 3M
6. Or approved equivalent.

B. Wires and Cables:

1. General:
 - a. General Cable
 - b. Okonite
 - c. Southwire
 - d. Encore Wire
 - e. Or approved equivalent.
2. Metal Clad Cable - Type MC:
 - a. Alflex
 - b. AFC
 - c. General Cable
 - d. Southwire
 - e. Encore Wire
 - f. Or approved equivalent.

C. Connectors:

1. Anderson Power Products
2. Burndy
3. Ilsco
4. 3M
5. Thomas & Betts
6. Or approved equivalent.

2.2 LUGS AND PADS

- A. Ampacity: Cross-sectional area of pad for multiple conductor terminations to match ampere rating of panelboard bus or equipment line terminals.
- B. Copper Pads: Drilled and tapped for multiple conductor terminals.

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- C. Lugs: Compression type for use with stranded branch circuit or control conductors; mechanical lugs for use with solid branch and feeder circuit conductors.

2.3 WIRES AND CABLES

- A. Building Wires:

1. Copper: Soft-drawn with conductivity of not less than 98 percent IACS at 20 degrees C (68 degrees F). 600 volt rated throughout. Conductors 12 AWG and 10 AWG, solid. Conductors 8 AWG and larger, stranded. 12 AWG minimum conductor size. Minimum insulation rating of 90 degrees C. Insulation Type: THHN/THWN-2.

- B. Phase color to be consistent at feeder terminations; A-B-C, top to bottom, left to right, front to back.

- C. Color Code Conductors as Follows:

PHASE	208 VOLT WYE	240 VOLT DELTA	480 VOLT
A	Black	Black	Brown
B	Red	Orange (High Leg)	Orange
C	Blue	Blue	Yellow
Neutral	White	White	Gray or White w/colored strip
Ground	Green	Green	Green

- D. MC Cable:

1. Standard: High strength galvanized steel flexible armor. Full length minimum size No. 12 copper ground wire, copper dual rated THHN/THWN-2, full length tape marker phase/circuit identification on cable armor. Short circuit throat insulators, mechanical compression termination.

- E. AC Cable (Armored Cable): Not allowed.

- F. NMB Cable: Not allowed.

2.4 CONNECTORS

- A. Split bolt connectors not allowed.

- B. Conductor Branch Circuits: Wire nuts with integral spring connectors for conductors 12 AWG through 8 AWG. Push-in type connectors where conductors are not required to be twisted together are not acceptable.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Install per manufacturer instructions and CEC.

- B. Field Quality Control:

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1. Test conductor insulation on feeders of 100 amp and greater for conformity with 1000 volt megohmmeter. Use Insulated Cable Engineers Association testing procedures. Minimum insulation resistance acceptable is 1 megohm for systems 600 volts and below. Notify Architect if insulation resistance is less than 1 megohm.
2. Test Report: Prepare a typed tabular report indicating the testing instrument, the feeder tested, amperage rating of the feeder, insulation type, voltage, the approximate length of the feeder, conduit type, and the measured resistance of the megohmmeter test. Submit test reports with project closeout documents.
3. Inspect and test in accordance with NETA Standard ATS, except Section 4.
4. Perform inspections and tests listed in NETA Standard ATS, Section 7.3.2.

3.2 LUGS AND PADS

- A. Thoroughly clean surfaces to remove all dirt, oil, great or paint.
- B. Use torque wrench to tighten per manufacturer's directions.

3.3 WIRES AND CABLES

- A. General:
 1. Do not install or handle thermoplastic insulated wire and cable in temperatures below -10 degrees C (14 degrees F). Do not handle thermoset insulated wire and cable in temperatures below -40 degrees C (-40 degrees F). All wire and cable must be acclimated to temperatures above freezing for no less than 24 hours prior to installation.
 2. Install conductors in raceways having adequate, code size cross-sectional area for wires indicated.
 3. Install conductors with care to avoid damage to insulation.
 4. Do not apply greater tension on conductors than recommended by manufacturer during installation.
 5. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation. Do not use pulling compounds for installation of conductors connected to GFCI circuit breakers or GFCI receptacles.
 6. Conductor Size and Quantity:
 - a. Install no conductors smaller than 12 AWG unless otherwise shown.
 - b. Provide required conductors for a fully operable system.
 - c. Power Circuits: No. 12 AWG minimum, except as follows:
 - 1) No. 10 AWG for 15A, 120V circuits longer than 100 ft.
 - 2) No. 8 AWG for 15A, 120V circuits longer than 150 ft.
 - 3) No. 10 AWG for 20A, 120V circuits longer than 70 ft.

- 4) No. 8 AWG for 20A, 120V circuits longer than 100 ft.
- d. When exact run lengths are determined for all branch circuits, and prior to installation of the conductors, ensure that the maximum voltage drop, based on 80 percent of the circuit protective device, does not exceed 3 percent. Increase wire size from #12AWG, if necessary, to ensure that the 3 percent voltage drop is not exceeded.
7. Provide dedicated neutrals (one neutral conductor for each phase conductor) in all 120V circuits.
- B. Conductors in Cabinets:
1. Cable and tree wires in panels and cabinets for power and control. Use plastic ties in panels and cabinets.
 2. Tie and bundle feeder conductors in wireways of panelboards.
 3. Hold conductors away from sharp metal edges.
- C. Homeruns:
1. Do not change intent of branch circuit homeruns without approval. Homeruns for 20A branch circuits may be combined to a maximum of six current carrying conductors including neutral conductors in homeruns. Apply derating factors as required per NEC. Increase conductor size as needed.
 2. MC cable homeruns are not allowed unless indicated on drawings.
- D. Identify wire and cable under the provisions of Section 26 05 53, Identification for Electrical Systems. Identify each conductor with its panel and circuit number as indicated.
- E. Exposed cable is not allowed.
- F. All cable must be run parallel or perpendicular to building lines and hidden from view when possible. Where installed in tray each power cable is to be identified with Lamacoid nametag engraved with identification of equipment being fed. Tag to be fastened to cable using tie-wraps. Provide nametag at each floor level.
- G. Do not install PVC jacketed cables in return air plenums, unless they are specially rated plenum cables.
- H. Use of MC Cable is limited to the following conditions. Installations that do not comply with the following conditions are to be removed and replaced with no additional expense to the Owner.
1. 15 and 20 amp branch wiring where following conditions apply:
 - a. Use MC cable for final flexible connections from junction or outlet boxes to recessed fixtures. Do not use MC cables to loop between fixtures, except where it is not practical to provide conduit connections between boxes or where existing inaccessible ceilings prevent installation of conduit runs. Each individual luminaire is to be serviced by an individual cable drop from the associated junction box in the ceiling space. Maximum length 6-feet of MC cable. Luminaire drops secured to,

and supported by, the building structure with nylon tie wraps. The use of the ceiling suspension system for support of any type of cabling is not permitted.

- b. MC cable may be routed in the void space above hard lid ceilings, and routed within wall cavities below glazing, provided CEC requirements are otherwise met, and a minimum one 0.75-inch conduit is routed from nearest accessible ceiling space to inaccessible location, terminating in a j-box with blank faceplate, for future circuits.

3.4 CONNECTORS

- A. Install to assure a solid and safe connection.
- B. Select hand twist connectors for wire size and install tightly on conductors.
- C. Install compression connectors using methods and tools recommended by the manufacturer.
- D. Do not install stranded conductors under screw terminals unless compression lugs are installed.
- E. Do not connect wiring without UL listed connectors that are listed for the purposes.

END OF SECTION

SECTION 26 0526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Grounding Electrodes
2. Connectors and Accessories
3. Grounding Busbar
4. Grounding Conductor

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Test reports of ground resistance for service and separately derived system grounds.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Comply with the requirements of ANSI/NFPA 70.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Grounding Electrodes:

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1. Erico
 2. Thomas & Betts
 3. Talley
 4. Or approved equivalent.
- B. Connectors and Accessories:
1. Burndy Hyground Compression System
 2. Erico/Cadweld
 3. Amp Ampact Grounding System
 4. Pipe Grounding Clamp:
 - a. Burndy GAR Series
 - b. O Z Gedney
 - c. Thomas & Betts
 - d. Or approved equivalent.
- C. Grounding Busbar:
1. Chatsworth
 2. Erico
 3. Schneider Electric/Square D
 4. Panduit
 5. Or approved equivalent.
- D. Grounding Conductor
1. General Cable
 2. Okonite
 3. Southwire
 4. Or approved equivalent

2.2 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, minimum 3/4-inch diameter, 10-feet long, tapered point, chamfered top.

2.3 CONNECTORS AND ACCESSORIES

- A. Grounding Connectors: Hydraulic compression tool applied connectors or exothermic welding process connectors or powder actuated compression tool applied connectors.
- B. Pipe Grounding Clamp: Mechanical ground connector with cable parallel or perpendicular to pipe.

2.4 GROUNDING BUSBAR

- A. Grounding Busbar: 1/4-inch thick by 4-inch high by 10-inch long copper grounding busbar with insulators that meet ANSI J-STD-607-A specifications. UL 467 listed. Hole patterns in busbar to accommodate two-hole lugs, four-hole configuration.

2.5 GROUNDING CONDUCTOR

- A. Grounding Electrode Conductor: Soft-draw bare stranded copper for wire sizes larger than #10 AWG Bare. Solid copper for wire sizes #10 AWG and smaller.
- B. Equipment Grounding Conductor: Green insulated, insulation type to match that of associated feeder or branch circuit wiring, size as indicated on drawings.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Verify site conditions prior to beginning work.
- B. Bond Sections of service equipment enclosure to service ground bus.
- C. Separately Derived Systems: Ground each separately derived system per NEC Article 250.
- D. Corrosion inhibitors: Apply a corrosion inhibitor to contact surfaces when making grounding and bonding connections. Use corrosion inhibitor appropriate for protecting a connection between metals used.
- E. Grounding system resistance to ground not to exceed 5 ohms. Make necessary modifications or additions to grounding electrode system for compliance. Submit final tests to assure that this requirement is met.
- F. Resistance of grounding electrode system: measure using a four-terminal fall-of-potential method as defined in IEEE 81. Take ground resistance measurements before electrical distribution system is energized and in normally dry conditions, not less than 48 hours after last rainfall. Take resistance measurements of separate grounding electrode systems before systems are bonded together below grade. Combined resistance of separate systems may be used to meet required resistance, but specified number of electrodes must still be provided.
- G. Inspect and test in accordance with NETA Standard ATS, Except Section 4.
- H. Perform inspections and tests listed in NETA Standard AB, Section 7.13.

3.2 GROUNDING ELECTRODES INSTALLATION

- A. Concrete-Encased Electrode ("Ufer Ground"):

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1. From service equipment ground bus provide grounding electrode conductor to footing/foundation rebar.
2. Bond #4 grounding electrode conductor to one minimum 20-foot long, 3/4-inch diameter independent steel rebar(s).
3. Protect grounding electrode conductor from footing/foundation to service equipment grounding bus with rigid PVC conduit where grounding electrode conductor passes through concrete floor or other concrete structure. Do not use rigid metal conduit for grounding electrode conductor protection.
4. Coordinate bonding of rebar in base of building concrete footing with installer prior to placement of concrete.

B. Ground Rod Electrode:

1. Verify that final backfill and compaction have been completed before driving rod electrodes.
2. Bond #6 grounding electrode conductor to driven ground rods as indicated on Drawings.
3. Tap at center ground rod and extend grounding electrode conductor to service grounding bus. Install grounding electrode conductor to service grounding bus in rigid PVC conduit for physical protection where grounding electrode conductor passes through concrete floor or other concrete structure.

C. Metal Underground Water Service: Bond water service pipe to service equipment ground bus or to the grounding electrode system. Connect to water pipe on utility side of isolating fittings or meters, bond across water meters.

D. Other Metal Piping Systems: Bond gas piping system, fire sprinkler piping system and other metal piping systems to service equipment ground bus or to the grounding electrode system.

E. Bond together metal siding not attached to grounded structure; bond to grounding electrode system.

3.3 CONNECTORS AND ACCESSORIES INSTALLATION

A. Install per manufacturer's instructions.

3.4 GROUNDING BUSBAR INSTALLATION

A. Install per manufacturer's instructions.

3.5 GROUNDING CONDUCTOR INSTALLATION

A. Raceways:

1. Ground metallic raceway systems. Bond to ground terminal with code size jumper except where code size or larger equipment grounding conductor is included with circuit, use grounding bushing with lay-in lug.
2. Connect metal raceways, which terminate within an enclosure but without mechanical connection to enclosure, by grounding bushings and ground conductor to grounding bus.

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3. Where equipment supply conductors are in flexible metallic conduit, install stranded copper equipment grounding conductor from outlet box to equipment frame.
 4. Install equipment grounding conductor, code size minimum unless noted on drawings, in metallic and nonmetallic raceway systems.
- B. Feeders and Branch Circuits:
1. Provide continuous green insulated copper equipment grounding conductors for feeders and branch circuits.
 2. Where installed in a continuous solid metallic raceway system and larger sizes are not detailed, provide insulated equipment grounding conductors for feeders and branch circuits sized in accordance with the latest adopted edition of NEC Article 250, Table 250-122.
- C. Bond boxes, cabinets, enclosures and panelboard equipment grounding conductors to enclosure with specified conductors and lugs. Install lugs only on thoroughly cleaned contact surfaces.
- D. Motors, Equipment and Appliances: Install code size equipment grounding conductor to (motor) equipment frame or manufacturer's designated ground terminal.
- E. Receptacles: Connect ground terminal of receptacle and associated outlet box to equipment grounding conductor. Self grounding nature of receptacle devices does not eliminate equipment grounding conductor bolted to outlet box.

END OF SECTION

SECTION 26 0529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Anchors, Threaded Rod and Fasteners
2. Support Channel, Hangers and Supports

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals not required for this Section.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Manufacturers regularly engaged in the manufacture of bolted metal framing support systems, whose products have been in satisfactory use in similar service for not less than 10 years.
2. Support systems to be supplied by a single manufacturer.
3. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, equipment hangers/supports, and seismic restraint by a qualified Structural Professional Engineer.
 - a. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.7 PERFORMANCE REQUIREMENTS

- A. General: Provide conduit and equipment hangers and supports in accordance with the following:
 - 1. When supports, anchorages, and seismic restraints for equipment and supports, anchorages and seismic restraints for conduit, cable tray and equipment are not shown on the Drawings, the Contractor is responsible for their design.
 - 2. Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- B. Engineered Support Systems: The following support systems to be designed, detailed, and bear the seal of a professional engineer registered in the State of California.
 - 1. Support frames such as conduit racks or stanchions for conduit and equipment which provide support from below.
 - 2. Equipment and piping support frame anchorage to supporting slab or structure.
- C. Provide channel support systems, for conduits to support multiple conduits capable of supporting combined weight of support systems and system contents.
- D. Provide heavy-duty steel trapezes for piping to support multiple conduit capable of supporting combined weight of supported systems and system contents.
- E. Provide seismic restraint hangers and supports for conduit and equipment.
- F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Anchors, Threaded Rod and Fasteners:
 - 1. Anchor It
 - 2. Epcon System
 - 3. Hilti-Hit System
 - 4. Power Fast System
 - 5. Or approved equivalent.
- B. Support Channel, Hangers and Supports:
 - 1. B-Line
 - 2. Kindorf
 - 3. Superstrut

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4. Unistrut
5. Or approved equivalent.

2.2 ANCHORS, THREADED ROD AND FASTENERS

- A. Anchors, Threaded Rod and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
- B. Concrete Inserts: Cast in concrete for support fasteners for loads up to 800 lbs.
- C. Anchors and Fasteners:
 1. Do not use powder-actuated anchors.
 2. Concrete Structural Elements: Use precast inserts.
 3. Steel Structural Elements: Use beam clamps.
 4. Concrete Surfaces: Use self-drilling anchors.
 5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts.
 6. Solid Masonry Walls: Use expansion anchors.
 7. Sheet Metal: Use sheet metal screws.
 8. Wood Elements: Use wood screws.
- D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.
- E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.
- F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

2.3 SUPPORT CHANNEL, HANGERS AND SUPPORTS

- A. Hangers and Supports - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
 1. Channel Material: Carbon steel.
 2. Coating: Hot dip galvanized.
- B. Pipe Straps: Two-hole galvanized or malleable iron.
- C. Luminaire Chain: 90 lb. test with steel hooks.
- D. Miscellaneous Metal: Provide miscellaneous metal items specified hereunder, including materials, fabrication, fastenings and accessories required for finished installation, where

indicated on Drawings or otherwise not shown on drawings that are necessary for completion of the project. The Contractor is responsible for their design.

1. Fabricate miscellaneous units to size shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
- E. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.
- F. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.
- G. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Fabrication - Miscellaneous Metals
 1. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on Drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates, and similar devices. Hot dipped galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.
 2. Finishes:
 - a. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with one coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas in primer with same material, before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.
 - b. Metal in contact with Concrete, Masonry and Other Dissimilar Materials: Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these

specifications.

- c. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

3.2 ANCHORS, THREADED ROD AND FASTENERS INSTALLATION

- A. Safety factor of 4 required for every fastening device or support for equipment installed.
Supports to withstand four times the weight of equipment it supports.
- B. Do not use other trade's fastening devices as supporting means for luminaires, equipment or materials.
- C. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- D. Do not use supports or fastening devices to support other than one particular item.
- E. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from floor above or roof structure to prevent sagging and swaying.
- F. Provide seismic bracing per CBC requirements.
- G. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- H. Use spring lock washers under fastener nuts for strut.
- I. Cutting and Drilling
 - 1. Do not drill or cut structural members without prior permission from Architect.

3.3 SUPPORT CHANNEL, HANGERS AND SUPPORTS INSTALLATION

- A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
- B. Safety factor of 4 required for every fastening device or support for equipment installed.
Supports to withstand four times the weight of equipment it supports.
- C. Verify mounting height of luminaires prior to installation when heights are not detailed.
- D. Install vertical support members for equipment and luminaires, straight and parallel to building walls.
- E. Install horizontal support members straight and parallel to ceilings or finished floor unless otherwise noted.
- F. Provide independent supports to structural member for luminaires, materials, or equipment installed in or on ceiling, walls or in void spaces or over suspended ceilings.
- G. Do not use other trade's fastening devices as supporting means for luminaires, equipment or materials.
- H. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- I. Do not use supports or fastening devices to support other than one particular item.

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- J. Support conduits within 18-inches of outlets, boxes, panels, cabinets and deflections unless more stringently required by CEC.
- K. Maximum distance between supports not to exceed 8 foot spacing unless otherwise required by CEC.
- L. Support flexible conduits and metal clad cable within 12-inches of outlets, boxes, panels, cabinets and deflections unless otherwise required by CEC.
- M. Maximum distance between supports for flexible conduits and metal clad cable not to exceed 48-inches spacing unless otherwise required by CEC.
- N. Maximum distance between supports for rigid PVC conduits unless otherwise required by CEC is as follows:
 - 1. 1/2-inch or 3/4-inch and 1-inch conduit, 3-feet apart.
 - 2. 1-1/4-inch or 1-1/2-inch and 2-inch conduit, 4-feet apart.
 - 3. 2-1/2-inch and 3-inch conduit, 5-feet apart.
 - 4. 4-inch and 5-inch conduit, 6-feet apart.
 - 5. 6-inch conduit, 7-feet apart.
- O. Maximum distance between supports for auxiliary gutters and wireways unless otherwise required by CEC is as follows:
 - 1. Sheet metal auxiliary gutters and wireways - 4-feet apart horizontally and 10-feet vertically.
 - 2. Non-metallic auxiliary gutters and wireways - 30-inches apart horizontally and 3-feet vertically.
- P. Install strut hangers as instructed by strut manufacturer. Suspend strut hangers as instructed by strut manufacturer for the load, with a maximum spacing of 8-feet on center and within 2-feet of outlet box, cabinet, junction box or other channel raceway termination unless otherwise required by CEC.
- Q. Coordinate routing of conduit racks with materials and equipment installed by other trades. Where conduit racks are exposed to view, coordinate location and installation with Architect for optimal appearance.
- R. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from floor above or roof structure to prevent sagging and swaying.
- S. Provide seismic bracing per CBC requirements.
- T. Where service disconnects are mounted on building exterior, physically attach service disconnect to the building or structure served.
- U. Install surface-mounted cabinets and panelboards with minimum of four anchors.

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- V. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

W. Wet and Damp Locations:

1. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1-inch off wall.

END OF SECTION

SECTION 26 0533
RACEWAYS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Rigid Metal Conduit (RMC)
 - 2. Electrical Metallic Tubing (EMT)
 - 3. Flexible Metal Conduit (FMC)
 - 4. Liquidtight Flexible Metal Conduit (LFMC)
 - 5. Conduit Fittings
- B. Provide a complete system of conduit and fittings, with associated couplings, connectors, and fittings, as shown on Drawings and described in these Specifications.

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
 - 1. Section 26 05 29, Hangers and Supports for Electrical Systems and Equipment
 - 2. Section 26 05 34, Boxes

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.7 DEFINITIONS

- A. Raceway system is defined as consisting of conduit, tubing, duct, and fittings including but not limited to connectors, couplings, offsets, elbows, bushings, expansion/deflection fittings, and other components and accessories. Complete electrical raceway installation before starting the installation of conductors and cables.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Rigid Metal Conduit (RMC):

1. Allied Tube & Conduit
2. Beck Manufacturing Inc.
3. Picoma
4. Wheatland Tube Company
5. Or approved equivalent.

B. Electrical Metallic Tubing (EMT):

1. Allied Tube & Conduit
2. Beck Manufacturing WL
3. Picoma
4. Wheatland Tube Company
5. Or approved equivalent.

C. Flexible Metal Conduit (FMC):

1. AFC Cable Systems Inc.
2. Electri-Flex Company
3. International Metal Hose
4. Or approved equivalent.

D. Liquidtight Flexible Metal Conduit (LFMC):

1. AFC Cable Systems Inc.
2. Electri-Flex Company
3. International Metal Hose
4. Or approved equivalent.

E. Conduit Fittings:

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1. Bushings:
 - a. Insulated Type for Threaded Raceway Without Factory Installed Plastic Throat Conductor Protection:
 - 1) Thomas & Betts 1222 Series
 - 2) O-Z Gedney B Series
 - 3) Or approved Equivalent.
2. Raceway Connectors and Couplings:
 - a. Thomas & Betts Series
 - b. O-Z Gedney Series
 - c. Or approved Equivalent.
3. Expansion/Deflection Fittings:
 - a. EMT: O-Z Gedney Type TX
 - b. RMC: O-Z Gedney Type AX, DX and AXDX, Crouse & Hinds XD
 - c. PVC: O-Z Gedney Type DX with PVC adapters, Carlon E945 Series, Kraloy OPEJ Series
 - d. Or approved equivalent.

2.2 RIGID METAL CONDUIT (RMC)

- A. UL 6, ANSI C80.1. Hot dipped galvanized steel conduit after thread cutting.
 1. Fittings: NEMA FB2.10.

2.3 ELECTRICAL METALLIC TUBING (EMT)

- A. Description: UL 797, ANSI C80.3; steel galvanized tubing.
- B. Fittings: NEMA FB 1; steel, compression type.

2.4 FLEXIBLE METAL CONDUIT (FMC)

- A. Description: UL 1, interlocked steel construction.
- B. Fittings: NEMA FB 2.20.

2.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Description: UL 360, inner core made from spiral wound strip of heavy gauge, hot dipped galvanized low carbon steel. 3/4-inch through 1-1/4-inch trade sizes to have a square lock core and contain an integral bonding strip of copper. 1-1/2-inch and larger to have fully interlocked core. Jacket material to be moisture, oil and sunlight resistant flexible PVC.

- B. Fittings: NEMA FB 2.20.

2.6 CONDUIT FITTINGS

A. Bushings:

1. Insulated type for threaded raceway connectors without factory-installed plastic throat conductor protection.
2. Insulated grounding type for threaded raceway connectors.

B. Raceway Connectors and Couplings:

1. Steel connectors, couplings, and conduit bodies, hot-dip galvanized.
2. Connector locknuts to be steel, with threads meeting ASTM tolerances. Locknuts to be hot-dip galvanized.
3. Connector throats (EMT, flexible conduit, metal clad cable and cordset connectors) to have factory installed plastic inserts permanently installed. For normal cable or conductor exiting angles from raceway, the cable jacket or conductor insulation to bear only on plastic throat insert.
4. Steel gland, Tomic or Breagle connectors and couplings are recognized for this Contract as having acceptable raceway to fitting electrical conductance.
5. Set screw connectors and couplings, without integral compression glands, are recognized for this Contract as not having acceptable raceway to fitting electrical conductance. A ground conductor sized per this Specification must be included and bonded within raceway assembly utilizing this type connector or coupling.

C. Provide expansion/deflection fittings for EMT.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Finished Surfaces: Schedule raceway installation to avoid conflict with installed wall and ceiling surfaces. If unavoidable, coordinate work and repairs with Architect.
- B. Conduit Size:
1. Minimum Size: 3/4-inch for power and control, unless otherwise noted. 3/4-inch for communication/data, unless otherwise noted. 3/4-inch for signal systems, unless otherwise noted.
- C. Underground Installations:
1. More than 5-feet from Foundation Wall: Use PVC.
 2. Within 5-feet from Foundation Wall: Use PVC coated RMC.
 3. In or Under Slab on Grade: Use PVC.
 4. Minimum Size: 1-inch.

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D. In Slab Above Grade:

1. Use PVC.
 2. Maximum Size Conduit in Slab: Contact Structural Engineer for maximum outside diameter of conduit.
- E. Provide two pull strings/tapes in empty conduits. Types:
1. Feeders: Polyester measure/pulling tape, Greenlee 4436 or approved.
 2. Branch Circuits and Low Voltage: Greenlee Poly Line 431 or approved.
 3. If fish tape is used for pulling line or low voltage wiring, fiberglass type to be used. Metal fish tapes will not be allowed.
 4. Secure pull string/tape at each end.
 5. Provide caps on ends of empty conduit to be used in future.
 6. Label both ends of empty conduits with location of opposite end.

F. Elbows: Use fiberglass or PVC coated RMC for underground installations.

G. Elbow for Low Energy Signal Systems: Use long radius factory ells where linking sections of raceway for installation of signal cable.

H. Verify that field measurements are as shown on Drawings.

I. Plan locations of conduit runs in advance of the installation and coordinate with ductwork, plumbing, ceiling and wall construction in the same areas.

J. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, and walls. Penetrations are acceptable only when the following occurs:

1. Where shown on the Structural Drawings.
2. As approved by the Structural Engineer prior to construction, and after submittal of drawing showing location, size, and position of each penetration.

K. Verify routing and termination locations of conduit prior to rough-in.

L. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

M. Install raceways securely, in neat and workmanlike manner, as specified in NECA 1, Standard Practices for Good Workmanship in Electrical Construction.

N. Install steel conduit as specified in NECA 101, Standard for Installing Steel Conduits.

O. Install nonmetallic conduit in accordance with manufacturer's instructions.

P. Inserts, anchors and sleeves.

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1. Coordinate location of inserts and anchor bolts for electrical systems prior to concrete pour.
2. Coordinate location of sleeves with consideration for other building systems prior to concrete pour.

Q. Conduit Supports:

1. Arrange supports to prevent misalignment during wiring installation.
 2. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
 3. Group related conduits; support using conduit rack. Construct rack using steel channel. Provide space on each for 25 percent additional conduits.
 4. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
 5. Do not attach conduit to ceiling support wires.
- R. Flexible steel conduit length not-to-exceed 6-feet, 3-feet in concealed walls. Provide sufficient slack to reduce the effect of vibration.
- S. Install conduit seals at boundaries where ambient temperatures differ by 10 degrees F or more as shown on the drawings. Install seals on warm side of partition.
- T. Seal raceways stubbing up into electrical equipment. Plug raceways with conductors with duct-seal. Cap spare raceways and plug PVC raceway products with plastic plugs as made by Underground Products, or equal, shaped to fit snugly into the stubup.
- U. Seal raceways penetrating an exterior building wall to prevent moisture and vermin from entering into the electrical equipment.
- V. Use suitable caps on spare and empty conduits to protect installed conduit against entrance of dirt and moisture.
- W. Keep 277/480 volt wiring independent of 120/208 volt wiring. Keep power wiring independent of communication system wiring.
- X. Keep emergency system wiring independent of other wiring systems per NEC 700.
- Y. Arrange conduit to maintain headroom and present neat appearance.
- Z. Do not install conduits on surface of building exterior, along vapor barrier, across roof, on top of parapet walls, or across floors, unless otherwise noted on drawings.
- AA. Exposed conduits are permitted only in following areas:
1. Mechanical rooms, electrical rooms or spaces where walls, ceilings and floors will not be covered with finished material.
 2. Existing walls that are concrete or block construction.

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3. Where specifically noted on Drawings.
 4. Route exposed conduit parallel and perpendicular to walls, tight to finished surfaces and neatly offset into boxes.
- BB. Do not install conduits or other electrical equipment in obvious passages, doorways, scuttles or crawl spaces which would impede or block area passage's intended usage.
- CC. Install continuous conduit and raceways for electrical power wiring and signal systems wiring.
- DD. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
- EE. Maintain adequate clearance between conduit and piping.
- FF. Keep conduits a minimum of 12-inches away from steam or hot water radiant heating lines (at or above 104 degrees F) or 3-inches away from waste or water lines.
- GG. Cut conduit square using saw or pipecutter; deburr cut ends.
- HH. Bring conduit to shoulder of fittings; fasten securely.
- II. Use conduit hubs to fasten conduit to cast boxes in damp and wet locations.
- JJ. Install no more than the equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams.
- KK. Use hydraulic one shot bender to fabricate elbows for bends in metal conduit larger than 2-inch size.
- LL. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- MM. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, and expansion joints.
- NN. Conduit Terminations for Signal Systems: Provide a plastic bushing on the end of conduit used for signal system wiring.
- OO. Feeders: Do not combine or change feeder runs.
- PP. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07, Thermal and Moisture Protection.
- QQ. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation and installer.
- 3.2 RIGID METAL CONDUIT (RMC) INSTALLATION**
- A. Outdoor Locations Above Grade: RMC.
 - B. Damp Locations: RMC.
 - C. In areas exposed to mechanical damage: RMC.
 - D. For security conduits installed exposed and subject to tampering: RMC.

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3.3 ELECTRICAL METALLIC TUBING (EMT) INSTALLATION

A. Dry Locations:

1. Concealed: EMT.
2. Exposed: EMT.

B. Dry, Protected: EMT.

3.4 FLEXIBLE METAL CONDUIT (FMC) INSTALLATION

- A. Dry Locations: Motors, recessed luminaires and equipment connections subject to movement or vibration, use flexible metallic conduit.
- B. Install 12-inch minimum slack loop on flexible metallic conduit.

3.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC) INSTALLATION

- A. Use PVC coated liquidtight flexible metallic conduit for motors and equipment connections subject to movement or vibration and subjected to any of following conditions: Exterior location, moist or humid atmosphere, corrosive environments, water spray, oil, or grease.
- B. Install 12-inch minimum slack loop on liquidtight flexible metallic conduit.

3.6 CONDUIT FITTINGS INSTALLATION

- A. Conduit Joints: Assemble conduits continuous and secure to boxes, panels, luminaires and equipment with fittings to maintain continuity. Provide watertight joints where embedded in concrete, below grade or in damp locations. Seal metal conduit with metal thread primer. Rigid conduit connections to be threaded, clean and tight (metal to metal). Threadless connections are not permitted for RMC.
- B. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- C. Use set screw type fittings only in dry locations. When set screw fittings are utilized provide insulated continuous equipment ground conductor in conduit, from overcurrent protection device to outlet.
- D. Use compression fittings in dry locations, damp and rain-exposed locations. Maximum size permitted in damp locations and locations exposed to rain is 2-inches in diameter.
- E. Use threaded type fittings in wet locations, hazardous locations, and damp or rain-exposed locations where conduit size is greater than 2-inches.
- F. Use PVC coated, threaded type fittings in corrosive environments.
- G. Use insulated type bushings with ground provision at switchboards, panelboards, safety disconnect switches, junction boxes that have feeders 60 amperes and greater.
- H. Condulets and Conduit Bodies:

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1. Do not use condulets and conduit bodies in conduits for signal wiring, in feeders 100 amp and larger, or for conductor splicing.
- I. Sleeves and Chases - Floor, Ceiling and Wall Penetrations: Provide necessary rigid conduit sleeves, openings and chases where conduits or cables are required to pass through floors, ceilings or walls.
- J. Expansion Joints:
 1. Provide conduits crossing expansion joints where cast in concrete with expansion-deflection fittings, installed per manufacturer's recommendations.
 2. Secure conduits 3-inches and larger to building structure on opposite sides of a building expansion joint with an expansion-deflection fitting across joint installed per manufacturer's recommendations.
 3. Provide conduits less than 3-inches where not cast in concrete with junction boxes securely fastened on both sides of expansion joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. In lieu of this flexible conduit, an expansion-deflection fitting, as indicated for conduits 3-inch and larger may be installed.
 4. Verify expansion/deflection requirements with Structural Engineer prior to installation.
- K. Seismic Joints:
 1. No conduits cast in concrete allowed to cross seismic joint.
 2. Provide conduits with junction boxes securely fastened on both sides of seismic joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. Prior to installation, verify with Architect that 15-inches is adequate for designed movement, and if not, increase this length as required.
 3. Provide conduits less than 3-inches where not cast in concrete with junction boxes securely fastened on both sides of expansion joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. In lieu of this flexible conduit, an expansion-deflection fitting, as indicated for conduits 3-inch and larger may be installed.
- L. Provide rigid conduit coupling flush with surface of slab or wall for conduit stubbed in concrete slab or wall to serve electrical equipment or an outlet under table or to supply shop tool, etc. Provide plug where conduit is to be used in future.

END OF SECTION

SECTION 26 0534
BOXES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Outlet Boxes
 - 2. Pull and Junction Boxes
 - 3. Box Extension Adapter
 - 4. Weatherproof Outlet Boxes
- B. Provide electrical boxes and fittings for a complete installation. Include but not limited to outlet boxes, junction boxes, pull boxes, bushings, locknuts and other necessary components.

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
 - 1. Section 26 05 33, Raceways
 - 2. Section 26 05 53, Identification for Electrical Systems

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Outlet Boxes:

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1. Hubbell
 2. Thomas & Betts
 3. Eaton/Crouse-Hinds
 4. Or approved equivalent.
- B. Pull and Junction Boxes:
1. Eaton/Crouse-Hinds
 2. Hoffman
 3. Or approved equivalent.
- C. Box Extension Adapter:
1. Hubbell
 2. Thomas & Betts
 3. Eaton/Crouse-Hinds
 4. Or approved equivalent.
- D. Weatherproof Outlet Boxes:
1. Legrand (Pass & Seymour)
 2. Hubbell
 3. Thomas & Betts
 4. Eaton/Crouse-Hinds
 5. Intermatic
 6. Or approved equivalent.

2.2 OUTLET BOXES

- A. Luminaire Outlet: 4-inch octagonal box, 1-1/2-inches deep with 3/8-inch luminaire stud if required. Provide raised covers on bracket outlets and on ceiling outlets.
- B. Device Outlet: Installation of one or two devices at common location, minimum 4-inches square, minimum 1-1/2-inches deep for non-USB type devices. Installation of one or two devices at common locations, minimum 4-inches square, minimum 2-inches deep for USB type devices. Single- or two-gang flush device raised covers.
- C. Telecom Outlet: Provide 4-inches square, minimum 2-1/8-inch deep box with two-gang plaster ring.
- D. Multiple Devices: Three or more devices at common location. Install one-piece gang boxes with one-piece device cover. Install one device per gang.

- E. Masonry Boxes: Outlets in concrete.
- F. Construction: For interior locations, provide galvanized steel outlet wiring boxes, of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. All surface mounted outlet boxes are to be drawn. Welded boxes are not acceptable.
- G. Accessories: Provide outlet box accessories for each installation, including mounting brackets, wallboard hangers, extension rings, luminaire studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.
- H. Noise Control: Provide acoustic putty pad to back side of each outlet box installed in acoustic rated walls.

2.3 PULL AND JUNCTION BOXES

- A. Construction: Provide ANSI 61 gray polyester powder painted sheet steel junction and pull boxes, with screw-on covers; of type shape and size, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.
- B. Location:
 1. Provide junction boxes above accessible ceilings for drops into walls for receptacle outlets from overhead.
 2. Provide junction boxes and pull boxes to facilitate installation of conductors and limiting accumulated angular sum of bends between boxes, cabinets and appliances to 270 degrees.
- C. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:
 1. Construction: Galvanized cast iron.
 2. Cover: Smooth cover with neoprene gasket and stainless steel cover screws.
 3. Cover Legend: ELECTRIC.
- D. Fiberglass Handholes: Die molded glass fiber hand holes:
 1. Cable Entrance: Pre-cut 6- x 6-inch cable entrance at center bottom of each side.
 2. Cover: Fiberglass weatherproof cover with nonskid finish.
 3. Cover Legend: ELECTRIC.

2.4 BOX EXTENSION ADAPTER

- A. Construction: Diecast aluminum.

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- B. Location: Install over flush wall outlet boxes to permit flexible raceway extension from flush outlet to fixed or movable equipment.

2.5 WEATHERPROOF OUTLET BOXES

- A. Construction: Provide corrosion-resistant cast metal weatherproof outlet wiring boxes, of the type, shape and size, including depth of box, with threaded conduit ends, cast metal faceplate with spring-hinged waterproof cap suitably configured for each application, including faceplate, gasket, blank plugs and corrosion proof fasteners. Weatherproof boxes to be constructed to have smooth sides, gray finish.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate locations of floor boxes and wall mounted wiring device boxes with architectural and structural floor plans prior to rough-in.
- B. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1, Standard Practice of Good Workmanship in Electrical Construction.
- C. Secure boxes rigidly to substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.
- D. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NEC. Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.
- E. Set wall mounted boxes at elevations to accommodate mounting heights shown on Architectural Elevations.
- F. Electrical boxes are shown on drawings in approximate locations unless dimensioned.
1. Adjust box locations up to 10-feet if required to accommodate intended purpose.
- G. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07, Thermal and Moisture Protection.
- H. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- I. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- J. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12-inches of box.
- K. Box Color Coding and Marking: Reference Section 26 05 53, Identification for Electrical Systems.
- L. Adjust boxes to be parallel with building lines. Boxes not plumb to building lines are not acceptable.
- M. Install knockout closures in unused box openings.

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- N. Clean interior of boxes to remove dust, debris, and other material.
- O. Clean exposed surfaces and restore finish.

3.2 OUTLET BOXES INSTALLATION

- A. Mount outlet boxes, unless otherwise required by ADA, or noted on drawings, following distances above finished floor:
 - 1. Control Switches:
 - a. 48-inches to the top of outlet box.
 - b. 4-inches above top of backsplash at countertops/workstations, not-to-exceed 44-inches above finished floor to the top of outlet box per ADA requirements.
 - 2. Receptacles: 15-inches to the bottom of outlet box.
 - 3. Telecom Outlets: 15-inches to the bottom of outlet box.
 - 4. Other Outlets: As indicated in other sections of specifications or as detailed on drawings.
- B. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6-inches from ceiling access panel or from removable recessed luminaire.
- C. Flush Outlets in Insulated Spaces: Maintain integrity of insulation and vapor barrier.
- D. Coordinate electrical device locations and elevations (switches and receptacles) with architectural drawings to prevent mounting devices in mirrors, back splashes, and behind cabinets.
- E. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- F. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices. Adjacent boxes not aligned vertically to be adjusted at no additional cost to Owner.
- G. Use flush mounting outlet box in finished areas.
- H. Do not install flush mounting box back-to-back in walls; provide minimum 6-inches separation. Provide minimum 24-inches in acoustic rated walls.
- I. In acoustical walls, apply acoustic putty pad on outlet box prior to installation of acoustical blanket.
- J. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- K. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- L. Use adjustable steel channel fasteners for hung ceiling outlet box.
- M. Use gang box where more than one device is mounted together. Do not use sectional box.
- N. Use gang box with plaster ring for single device outlets.

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- O. Adjust flush-mounting outlets to make front flush with finished wall material.

3.3 PULL AND JUNCTION BOXES INSTALLATION

- A. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- B. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6-inches from ceiling access panel or from removable recessed luminaire.
- C. Do not fasten boxes to ceiling support wires.
- D. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.4 BOX EXTENSION ADAPTER INSTALLATION

- A. Match material to box.
- B. Install gaskets at exterior and wet locations.

3.5 WEATHERPROOF OUTLET BOXES INSTALLATION

- A. Use cast outlet box in exterior locations exposed to weather and wet locations.
- B. Install gaskets.

END OF SECTION

SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Equipment Nameplates
2. Device Labels
3. Wire Markers

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals not required for this Section.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.
2. Manufacturer's standard products of categories and types required for each application as referenced in other Division 26, Electrical Sections. Where more than a single type is specified for application, provide single selection for each product category.
3. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Equipment Nameplates:

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1. B & I Nameplates
 2. Intellicum
 3. JBR Associates
 4. Or approved equivalent.
- B. Device Labels:
1. Kroy
 2. Brady
 3. Or approved equivalent.
- C. Wire Markers:
1. Brady
 2. Panduit
 3. Sumitomo
 4. Or approved equivalent.
- 2.2 EQUIPMENT NAMEPLATES**
- A. Engraved phenolic plastic, laminate, minimum 1/8-inch thick in the size indicated, with beveled edge border matching letter color. Federal specification L-P-387. All upper case letters in engraver standard letter style of the size and wording indicated. Punched for mechanical fastening, except where adhesive mounting is necessary due to substrate. Embossed tape style labels are not acceptable.
- B. Color:
1. Normal (Utility): White letters on black background.
 2. Life Safety/Critical (Emergency Systems): Black letters on orange background.
- C. Letter Size:
1. Use 1/2-inch letters minimum for identifying major equipment and loads, including switchgear, switchboards, etc.
 2. Use 1/4-inch or 1/2-inch letters minimum for identifying panels, breakers, etc.
 3. Use 3/16-inch minimum for identifying source, voltage, current, phase, and wire configurations.
- D. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
- E. The Architect, Engineer, Commissioning Agent and Owner reserve the right to make modifications to the nameplates as necessary.

F. Locations:

1. Switchgear, switchboards, sub-distribution switchboards, distribution panels, and branch panels.
2. Main breakers and distribution breakers in switchgear, switchboards, and distribution panels.
3. Equipment including, but not limited to, motor controllers, disconnects, and VFDs.
4. Low-voltage equipment enclosures including, but not limited to, fire alarm panels, access control panels, and lighting control panels.
5. Distribution transformers.

2.3 DEVICE LABELS

- A. Extra strength, laminated adhesive tape, with 3/16-inch black letters on clear background. Use only for identification of individual wall switches and receptacles. Indicate device name, source panel, and source circuits. Panel and circuit designation written in permanent marker on the back of the plate and inside the back-box. Do not provide punch tape style labels.
- B. Label all junction boxes to show system identification, source circuit, or raceway origin. In finished areas, utilize device label. In unfinished areas or above ceilings, use of permanent ink marker is acceptable.

2.4 WIRE MARKERS

- A. Description: Vinyl-cloth self-adhesive type wire markers.
- B. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, junction boxes, and each load connection.
- C. Power and Lighting Circuits: Branch circuit or feeder number as indicated on drawings and source panel.
- D. Control Circuits: control wire number indicated on schematic and interconnection diagrams on drawings or shop drawings.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate designations used on Drawings with equipment nameplates and device labels.
- B. Install nameplates and labels parallel to equipment lines.
- C. Identify empty conduit and boxes with intended use.
- D. Provide typewritten branch panel schedules with protective clear transparent covers accounting for every breaker installed. Use actual room designations assigned by name or number near completion of the work, and not the designations shown on drawings.

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3.2 Equipment Nameplates

- A. Degrease and clean surfaces to receive nameplates.
- B. Secure equipment nameplates to equipment front using self-tapping stainless steel screws.
- C. Secure equipment nameplates to inside surface of door on panelboard that is recessed in finished locations.
- D. Verify emergency system distribution equipment nameplate colors with Architect/Owner.
- E. Switchgear, switchboards, and panels to include name source, voltage, current phase, wire configuration and fault current rating. Transformers to include source KVA, and secondary voltage, phase, and wire configuration.
- F. Provide nameplates for flush mounted branch panelboards identifying name on front door. On inside of door provide nameplate as noted above. Verify with Architect/Owner if nameplate on outside of door is required.
- G. Provide a second label at branch panelboards listing the means of identification of branch circuit conductors. This identification legend to consist of the color code used for each voltage system (208Y/120V and 480Y/277V). Include identification of both voltage systems on each label, regardless of the voltage of the panelboard to which the label is affixed. Comply with requirements of NEC 210.5.
 1. See Specification Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables, for required conductor color code for this project.

3.3 Device Labels

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Degrease and clean surfaces to receive labels.

3.4 Wire Markers

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide wire markers on each conductor for power, control, signalling and communications circuits.
- D. Where switches control remote lighting or power outlets, or where switches or outlets in same location serve different purposes, such as light, power, intercom, etc. or different areas, such as corridor and outside, provide plates with 1/8-inch black letters indicating function of each switch or outlet. Also label the function of light switches where two or more are mounted in same locations.

END OF SECTION

SECTION 26 0573
ELECTRICAL DISTRIBUTION SYSTEM STUDIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
1. Protective Devices
 2. Short Circuit Study
 3. Selective Coordination Study
 4. Arc Flash Labels
 5. Arc Flash Risk Assessment
 6. Load-Flow and Voltage Drop Study

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. IEEE 242, Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
 2. IEEE 399, Recommended Practice for Industrial and Commercial Power Systems Analysis.
 3. IEEE 1584, Guide for Performing Arc Flash Calculation.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition provide:
1. Power system studies required under this Section with submittals for electrical equipment, including overcurrent protective devices.
 2. Electrical equipment ordered prior to submittal and approval of power system studies are not compliant with these specifications, and are subject to removal and replacement at no cost to Owner where not in compliance with Code and Contract Documents for selective coordination.

- a. Provide written verification with Stamp or Seal and signature of preparing Engineer.

- 3. Provide samples of NFPA 70E compliant arc flash hazard labeling for electrical equipment.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

- B. In addition, meet the following:

- 1. Study Preparer Qualifications: Qualified engineer of switchgear manufacturer or approved professional engineer.
 - a. Experienced in preparation of studies of similar type and magnitude.
 - b. Familiar with software analysis products specified.
- 2. Computer Software for Study Preparation: Use latest edition of commercially available software utilizing specified methodologies.
 - a. Acceptable Software Products:
 - 1) EasyPower
 - 2) Operation Technology, Inc; ETAP.
 - 3) SKM Systems Analysis, Inc; Power Tools for Windows.
- 3. Contractor Responsibility: Provide project-related data needed by study preparer, including equipment, wire sizes, insulation types, conduit types, actual circuit lengths and available fault currents from utility. Provide information in a timely matter to allow studies to be completed prior to release of equipment.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Analyze specific electrical and utilization equipment (according to NEC definition), actual protective devices to be used, and actual feeder lengths to be installed.
 - 1. Scope of Studies: New and existing distribution wiring and equipment, from primary source to buses and branch circuit panelboards.
 - 2. Primary Source, for Purposes of Studies: Utility company primary protective devices.
 - 3. Study Methodology: Comply with requirements and recommendations of NFPA 70, IEEE 399, and IEEE 242.

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4. Report: State methodology and rationale employed in making each type of calculation; identify computer software package(s) used.
- B. One-Line Diagrams: Prepare schematic drawing of electrical distribution system, with electrical equipment and wiring to be protected by protective devices; identify nodes on diagrams for reference on report that includes:
1. Calculated fault impedance, X/R ratios, utility contribution, and short circuit values (asymmetric and symmetric) at main switchboard bus and downstream devices containing protective devices.
 2. Breaker and fuse ratings.
 3. Generator kW and voltage ratings, percent impedance, X/R ratios, and wiring connections.
 4. Transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
 5. Identification of each bus, with voltage.
 6. Conduit materials, feeder sizes, actual lengths, and X/R ratios.

2.2 UTILITY DATA

- A. Utility Data Objectives
1. Various electrical utility companies provide utility fault current data in varying forms; however, minimum utility data requirements must be obtained. Should information not be provided after multiple attempts, follow the procedure below.
 2. The objective of gathering data from the utility is to obtain actual fault current levels at the point of connection with facility, based on present distribution conditions and the characteristics of the actual physical transformer currently serving the facility.
 3. As IEEE Standard 1584 states: "Available fault data must be realistic; not conservatively high." In general, due diligence by the Engineer of Record (EoR) is needed in reviewing the data provided.
- B. Desired Utility Data Requirements
1. The following utility data is desired and shall be obtained as much as possible:
 - a. Primary Fault Current, 3-Phase, Phase to Ground (maximum and minimum)
 - b. Secondary Fault Current, Phase-to-Ground (maximum and minimum)
 - c. 3-Phase X/R
 - d. Phase-Ground X/R
 - e. Service Conductors: Quantity, Size, Type (Al or Cu) per phase, and distance from Transformer

- f. Utility Transformer: Size (KVA), winding configuration, and Impedance (%Z)
- g. Ratings, types, and settings of utility companies' over-current protection devices.

C. Minimum Utility Data Requirements

1. The minimum acceptable data for actual fault current information received shall be 3-phase secondary fault current and connection type, OR- three phase primary fault current, utility transformer KVA, primary and secondary voltage, impedance and connection type.
2. IEEE Std. 1584-2018 recommends that maximum and minimum fault current be obtained from the Utility Company for various switching conditions and the worst-case PPE requirement and rating of the panels should be selected from both the scenarios.
3. If utility does not provide X/R ratio for the transformer, then IEEE 141 and 242 typical values would be acceptable.
4. If the primary OCPD information is not available, then use the 2 second rule for the cut-off.
5. The report shall include the assumed values in the section where the utility data is normally placed per the specifications.

D. Arc Flash Incident Energy and Underrated Panels

1. To determine the Arc Flash Incident Energy and underrated panels the worst-case results shall be used resulting from either the actual utility data or the assumed utility data

2.3

2.4 PROTECTIVE DEVICES

- A. Provide protective devices of ratings and settings as required so that protective device closest to fault will open first.
- B. Replace existing protective devices to achieve specified performance.
- C. Analyze and determine ratings and settings of protective devices to minimize damage caused by fault and so that protective device closest to fault will open first.
 1. Required Ratings and Settings: Derive required ratings and settings of protective devices in consideration of upstream protective device settings and optimize system to ensure selective coordination.
 2. Motors with Solid-State Protective Modules: Select settings for best possible motor protection, taking into consideration actual installed motor torque and current and thermal characteristics.
 3. Identify any equipment that is underrated as specified.
 4. Identify specified protective devices that will not achieve required protection or coordination but with minor changes can be made to do so; provide such modified devices at no additional cost to Owner and identify them on submittals as "revised in

accordance with Protective Device Coordination Study"; minor changes include different trip sizes in same frame, time curve characteristics of induction relays, CT ranges, etc.

5. Identify specified protective devices that will not achieve required protection or coordination and cannot be field adjusted to do so, and for which adequate devices would involve change to contract sum.
 6. In all cases where adequate protection or coordination cannot be achieved at no extra cost to Owner, provide a discussion of alternatives and logical compromises for best achievable coordination.
 7. Do not order, furnish, or install protective devices that do not meet performance requirements unless specifically approved by Engineer.
- D. Protective Device Rating and Setting Chart: Summarize in tabular format required characteristics for each protective device based on analysis; include:
1. Device identification.
 2. Relay CT ratios, tap, time dial, and instantaneous pickup.
 3. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
 4. Fuse rating and type.
 5. Ground fault pickup and time delay.
 6. Input level and expected response time at two test points that are compatible with commonly available test equipment and ratings of protective device.
 7. Highlight devices that as furnished by Contractor will not achieve required protection.
- E. Specified equipment has been designed and selected to achieve specified performance; ensure that equipment actually installed provides that performance.
- F. In addition to requirements specified elsewhere, provide overcurrent protective devices having ratings and settings in accordance with results of system studies.

2.5 SHORT CIRCUIT STUDY

- A. Calculations shall include the utility company source impedance, including transformer impedances, upstream available fault current, X/R ratio, etc. and 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.
- B. 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.

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2. Switchgear.
3. Unit substation primary and secondary terminals.
4. Low-voltage switchgear.
5. Generators and generator tap boxes.
6. Automatic Transfer Switches.
7. Motor-control centers.
8. Standby generators and automatic transfer switches.
9. Branch circuit panelboards, including a representative branch circuit breaker.
10. Disconnect switches.
11. Variable Frequency Drives (VFD)
12. Large Heating Ventilating and Air Conditioning (HVAC) equipment, above 50 HP.

C. 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.

D. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

1. Voltage.
2. Calculated fault-current magnitude.
3. Fault-point X/R ratio.
4. Equivalent impedance.

E. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

1. Voltage.
2. Calculated symmetrical fault-current magnitude.
3. Fault-point X/R ratio.
4. Calculated asymmetrical fault currents:
 - a. Based on fault-point X/R ratio.
 - b. Based on calculated symmetrical value multiplied by 1.6.

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5. 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.
 - c. Fault-point X/R ratio.
- F. Short Circuit Underrated Equipment : Provide a single comprehensive report indicating each underrated piece of equipment, its rating, and the available half cycle fault current.
- G. Overall Short Circuit Underrated Equipment spreadsheet: Provide a single comprehensive report for all buildings covered by the study indicating each piece of underrated equipment, its actual rating, and the available half cycle fault current in Excel spreadsheet format. (Single or multiple pages per building compiled into one report for all building covered by the respective A/E firms).
- H. Major remediation of underperforming equipment, such as “underrated” busduct, feeders, panelboards, switchboards, etc. or changing individual “underrated” breakers shall not be the work of this section and shall be performed as a future project initiated by the Project Manager.

2.6 SELECTIVE COORDINATION STUDY

- A. For all emergency, legally required standby and critical operations systems over current devices, perform an organized time-current analysis of each protective device in series from individual device back to source, under normal and emergency power conditions.
1. Graphically illustrate that adequate time separation exists between series devices, including upstream primary device.
 2. Plot specific time-current characteristics of each protective device on log-log paper.
 3. Organize plots so that upstream devices are clearly depicted on one sheet.
 4. Also show following on curve plot sheets:
 - a. Device identification.
 - b. Voltage and current transformer ratios for curves.
 - c. 3-phase and 1-phase ANSI damage curves for each transformer.
 - d. No-damage, melting, and clearing curves for fuses.
 - e. Cable damage curves.
 - f. Transformer inrush points.
 - g. Maximum short circuit cutoff point.
 - h. Simple one-line diagram for portion of system that each curve plot illustrates.
 - i. Software report for each curve plot, labeled for identification.

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- B. Devices to coordinate down to 0.01 seconds. Coordination required for emergency systems, legally required systems, and elevators.

2.7 ARC FLASH LABELS

- A. Arc flash labels shall be based on the recommended overcurrent protective devices settings and the replacement of mismatched fuses. For underrated equipment requiring remediation and/or equipment rated above 40 cal. /cm², appropriate arc flash labels as indicated below shall be applied.
- B. Apply one arc-flash label on all applicable electrical equipment, for each circuit breaker or disconnect and per accessible vertical section in all multiple section pieces of equipment.
- C. Labels shall meet UL 969 standard, compliance for durability and adhesion.
- D. Labels shall be based on the highest incident energy available from all the scenarios considered for the study.
- E. Provide labels based on improved conditions which includes, properly matched fuses and properly adjusted breakers (by Engineering Study Specialists).
- F. Arc Flash labels shall be similar to and indicate all the required data as shown in the labels below:
- G. Include copies of all labels in the report.
- H. Do not put a sticker on any breaker's integral access panel which may inhibit inspection of the trip unit or any other breaker components.
- I. For above 40 cal. /cm²:
- J. For less than or equal to 1.2 cal. /cm²
- K. For greater than 1.2 cal./cm² and up to 12 cal./cm²:
- L. For greater than 12 cal./cm² and up to 40 cal./cm²:
- M. For all underrated equipment, furnish and install labels similar to the examples below and with the following information:
1. DANGER in red large type font.
 2. Background color shall be white.
 3. Fault circuit rating of device.
 4. Fault current at the device

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5. Indicate "EQUIPMENT UNDERRATED" in block caps and large type font.
6. Equipment name, date and company that performed the calculations.

2.8 ARC FLASH RISK ASSESSMENT

- A. Comply with NFPA 70E and its Annex D for hazard analysis study. Arc Flash labels shall be based on the scenario with the highest incident energy.
- B. Employ the following methodology:
 1. Use the short-circuit study output and the field verified settings of the overcurrent devices.
 2. Calculate maximum contributions of fault-current size.
 3. The maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
 4. Calculate the arc-flash protection boundary and incident energy at locations in the electrical distribution system where personnel could perform work on energized parts.
 5. The Arc Flash Boundary shall be specified for calculated fault locations based on an incident energy of 1.2 cal./cm².
 6. 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 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:
 - a. Fault contribution from induction motors should not be considered beyond three to five cycles.
 - b. 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).
 7. Arc flash computation shall include both line and load side of a circuit breaker as follows:
 - a. When the circuit breaker is in a separate enclosure.
 - b. When the line terminals of the circuit breaker are separate from the work location.
 8. Base arc flash calculations on actual overcurrent protective device clearing time. Use the maximum clearing time at two seconds based on IEEE 1584, Section B.1.2. Two second maximum arcing time should be limited to those devices with an actual clearing time greater than two seconds.
 9. Provide arc flash energy results for each location. (Category levels of arc flash are not to be applied).

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10. Arc Flash calculations shall be made for all pertinent scenarios, including but not limited to On Utility, On Generator and On portable generator (at Tap Box), Main-Tie-Main, On UPS, On UPS Bypass. For facilities with permanent generators, the assumption for the study should be that any roll-up generator would be assumed to match the ratings of the fixed generator. For facilities with no permanent generator but only provisions for a roll-up generator, assume generator sizing equal to the capacity of the service entrance. Provide a label based on this calculation. The assumption should only be made if the owner cannot provide the information within 10 working days from the date of the request.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Provide services of qualified field engineer and necessary tools and equipment to test, calibrate, and adjust installed protective devices to conform to requirements determined by coordination analysis.
- B. Adjust installed protective devices having adjustable settings to conform to requirements determined by coordination analysis.
- C. Submit report showing final adjusted settings of protective devices.

3.2 ELECTRICAL POWER SYSTEM STUDIES

- A. Short Circuit Analysis Study:
 1. Provide complete short circuit study, equipment interrupting and withstand evaluation. Study to include complete electrical distribution system, including contributions from normal source of power without alternative sources of power. Include complete low voltage distribution systems as specified in this Section.
 2. Study Basis: thoroughly cover normal and alternative operation modes that can produce maximum fault conditions, including simultaneous motor contributions.
 3. Perform study in accordance with applicable ANSI/IEEE Standards.
 4. Study Input Data: Utility company short circuit single and three phase contribution, and X/R ratio; resistance and reactance components of each feeder, busway and branch impedance; motor and generator contributions; applicable circuit parameters and contribute to short circuit duty.
 5. Calculate short circuit momentary duties and interrupting duties on basis of maximum available fault current at each switchgear bus, switchboard, motor control center, panelboards, transfer switches, busway plug connection point, dry-type transformer primary and secondary locations, other significant locations throughout system affected by available fault current (including large HVAC units, uninterruptible power supplies, etc.).
 6. Perform equipment evaluation study to determine adequacy of overcurrent protection devices by tabulating and comparing short circuit ratings of these devices with available fault current. Notify Owner in writing where problem areas or inadequacies appear in electrical equipment.

7. Study Report: In bound final report, include sheets listing tabulated information from study, including feeder impedances, motor, utility and generator impedances and fault contributions, and resulting short circuit current including asymmetrical, symmetrical, three, five and eight cycle fault current levels, and line-to-neutral and three-phase-bolted-fault current levels at each calculated point in electrical distribution system.

B. Selective Coordination Study:

1. Perform time-current coordination analysis with aid of computer software intended for this purpose. Include determination of settings, ratings, or types for overcurrent protective devices supplied.
2. Where necessary, make an appropriate compromise between system protection and service continuity with service continuity considered more important than system protection.
3. Provide sufficient number of computer generated log-log plots to indicate degree of system protection and coordination by displaying time-current characteristics of series connected overcurrent devices and other pertinent system parameters.
4. 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:
 - a. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
 - b. Terminate device characteristic curves at a point reflecting maximum symmetrical fault current to which the device is exposed.
 - c. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
 - d. No more than 3 devices per TCC.
 - e. Plot the following listed characteristic curves, as applicable:
 - 1) Power utility's overcurrent protective device.
 - 2) Medium-voltage equipment overcurrent relays.
 - 3) Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
 - 4) Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
 - 5) Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
 - 6) Cables and conductors damage curves.

- 7) Ground-fault protective devices.
 - 8) Generator short-circuit decrement curve and generator damage point.
 - 9) The largest feeder circuit breaker in each motor-control center and panelboard.
 5. Study includes separate, tabular computer printout containing suggested device settings of adjustable overcurrent protective devices, equipment where device is located, and device number corresponding to device on system one-line diagram.
 6. Provide computer generated system one-line diagram which clearly identifies individual equipment buses, bus numbers, device identification numbers and maximum available short-circuit current at each bus when known.
 7. Discussion Section which evaluates degree of system protection and service continuity with overcurrent devices, along with recommendations as required for addressing system protection or device coordination deficiencies.
 8. Call significant deficiencies in protection and/or coordination to attention of Engineer and recommendations made for improvements as soon as they are identified.
 9. Contractor responsible for supplying pertinent electrical system conductor, circuit breaker, generator, and other component and system information in timely manner to allow time-current analysis to be completed prior to final installation.
- C. Arc Flash Risk Assessment:
1. Perform arc flash risk assessment with aid of computer software intended for this purpose.
 2. Perform arc flash risk assessment in conjunction with short-circuit analysis and time-current coordination analysis.
 3. Submit results of assessment in tabular form, and include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, personal-protective equipment classes and AFIE levels.
 4. Perform analysis under worst-case arc flash conditions, and final report describes, when applicable, how these conditions differ from worst-case bolted fault conditions.
 5. Arc flash risk assessment includes recommendations for reducing AFIE levels and enhancing worker safety.
 6. Proposed vendor demonstrates experience with arc flash risk assessment by submitting names of at least ten actual arc flash risk assessments it has performed in past year.
 7. Proposed vendor demonstrates capabilities in providing equipment, services, and training to reduce arc flash exposure and train workers in accordance with NFPA 70E and other applicable standards.
 8. Proposed vendor demonstrates experience in providing equipment labels in compliance with CEC and ANSI Z535.4 to identify AFIE and appropriate Personal Protective

Equipment classes.

D. Load-Flow And Voltage Drop Study:

1. Perform a load-flow and voltage drop study to determine the steady state loading profile of the system. Determine load-flow and voltage drop based of full load current shown in the design. The model should include all loads indicated in the panel schedules, one-line diagram, and equipment connection schedules, as applicable.
2. Prepare the load-flow and voltage-drop analysis and report to show power system components that are overloaded; indicate voltage drop for all buses in the system.
3. Provide recommendations for areas that have voltage drop values higher than 2-percent for feeders.
4. Indicate the recommended fixed transformer taps that might be used to solve the voltage drop issues.

END OF SECTION

SECTION 26 0805
ELECTRICAL ACCEPTANCE TESTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Testing, evaluation, and calibration of:
 - 1. Power Distribution Equipment
- B. Test procedures specified in this Section are in addition to those specified in other Sections of Division 26, Electrical.

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Acceptance Testing Criteria: Latest edition of Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, published by NETA.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Test Reports:
 - a. Maintain written record of tests.
 - b. At completion of project, assemble and certify a final test report. Document testing and performance compliance with NETA recommended forms, parameters, and level of detail. Submit report to Architect prior to final acceptance to include:
 - 1) Summary of Project
 - 2) Description of Equipment Tested
 - 3) Visual Inspection Report
 - 4) Description of Tests
 - 5) Test Results
 - 6) Conclusions and Recommendations

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1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Qualifications of Testing Firm:
 - a. Corporately independent testing organization which can function as an unbiased testing authority, professionally independent of manufacturers, suppliers and installers of equipment or systems evaluated by testing firms.
 - b. Independent organization as defined by a NETA Level II ETT certified testing agency in compliance with NETA Level II ETT certified testing requirements and practices.
 - c. Regularly engaged in testing of electrical materials, devices, appliances, electrical installations and systems for purpose of preventing injury to persons or damage to property and other equipment.
 - d. Engaged in testing practices for minimum of five years.
 - e. Use only full-time technicians, regularly employed by firm for testing services. Electrically unskilled employees are not permitted to perform testing or assistance of any kind. Electricians and line workers may assist, but may not perform testing or inspection services.
 - f. Submit proof of above qualifications with Bid Documents.
 - 2. Certifications:
 - a. Comply with NETA Level II ETT certified testing agency criteria for accreditation of testing laboratories. Full membership in NETA constitutes proof of such criteria.
 - b. Lead, on site, technical person currently certified by NETA in Electrical Power Distribution System Testing.
 - c. Instruments used by testing firm to evaluate electrical performance meet NETA Specifications for Test Instruments.

1.6 PERFORMANCE REQUIREMENTS

- A. Retain services of recognized independent testing firm for purpose of performing inspections and tests as specified.
- B. Independent test firm providing report direct to Architect.
- C. Material, equipment, labor and technical supervision to perform tests and inspections provided by testing firm.
- D. Intent of these tests to assure that electrical equipment, Contractor or Owner supplied, is operational within industry and manufacturer's tolerances and is installed in accordance with design Specifications.

- E. Tests and inspections determine suitability for energization.
- F. Supply to independent testing organization complete sets of approved shop drawings, coordination study (provided by Contractor's equipment supplier under Contractor's direction), setting of adjustable devices and other information requested by testing agency.

1.7 SCOPE OF WORK

- A. Provide testing, evaluation, and calibration of the following:
 - 1. Dry Type Transformers
 - 2. Low Voltage Circuit Breakers (greater than 100 amp)
 - 3. Switchboards
 - 4. Panelboards
 - 5. Grounding Systems
 - 6. Automatic Transfer Switches
- B. Test cable, equipment and systems listed above to assure proper installation, setting, connections, and functioning in accordance with the Drawings, Specifications, and the manufacturer's recommendations. It is the intent that field testing be extensive, and complete as specified, to provide positive assurance of totally correct installation and operation of equipment.
- C. Furnish necessary test equipment to satisfactorily perform tests specified.

PART 2 - PRODUCTS

2.1 POWER DISTRIBUTION EQUIPMENT

- A. The testing agency provides test equipment.
- B. Care and Precautions:
 - 1. Contractor responsible for any damage to equipment or material due to improper test procedures or test apparatus handling. Replace or restore to original condition any damaged equipment or material.
 - 2. Provide and use safety devices such as rubber gloves and blankets, protective screen, barriers and danger signs to adequately protect and warn personnel in the vicinity of the tests.
 - 3. Use test equipment that is calibrated and certified traceable to the National Bureau of Standards. Certification Date: No later than 6 months.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Tests:

1. Contractor's Responsibilities:

a. Perform routine insulation resistance, continuity and rotation tests for distribution and utilization equipment prior to and in addition to tests performed by testing firm.

b. Notify testing firm when equipment becomes available for acceptance tests.
Coordinate work to expedite project scheduling.

2. Testing Firm's Responsibilities:

a. Notify Architect prior to commencement of any testing.

b. Report directly to Architect any systems, material or installation found defective on basis of acceptance tests.

c. Provide auxiliary portable power supply necessary for conducting tests.

3.2 REPLACEMENT OF DEFECTIVE MATERIAL OR EQUIPMENT

A. Repair or replace any material or equipment found defective or cannot pass the tests specified in this Section at no additional cost to the Owner.

B. Complete correction of defective material or equipment and retesting within the Contract period.

C. If the equipment or material cannot pass the second test, remove the defective equipment and replace it with equivalent equipment that meets the requirements of the Specifications. Such replacement at no additional cost to the Owner.

3.3 ADJUSTING

A. Final Settings: Testing firm responsible for implementing final settings and adjustments on protective devices and tap changes in accordance with Architect's specified values.

END OF SECTION

SECTION 26 0925
DIGITAL LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included:
1. General Performance
 2. Digital Wall or Ceiling Mounted Occupancy Sensor System
 3. Digital Wall Switches
 4. Room Controllers
 5. Room Network (DLM Local Network)
 6. Configuration Tools
 7. Network Bridge
 8. Segment Manager
 9. Emergency Lighting
 10. Source Quality Control
- B. Basis of Design: Daylighting and occupancy sensor layout on Drawings are designed based on Wattstopper product line. Approved manufacturers listed below are allowed on condition of meeting specified conditions including complete sensor coverage of area controlled and switching of luminaires in area controlled. Provide additional sensors and room controllers as needed to provide same level of functionality as shown on Drawings. Remove and replace electrical equipment installed not meeting these conditions at no cost to Owner.
- C. System Description and Operation:
1. The Lighting Control and Automation system as defined under this section covers the following equipment:
 - a. Digital Room Controllers: Self-configuring, digitally addressable one, two, or three relays controllers with 0-10 volt control for LED drivers (if applicable) and single relay application-specific plug load controllers.
 - b. Digital Occupancy Sensors: Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
 - c. Digital Switches: Self-configuring, digitally addressable pushbutton switches, dimmers, and scene switches with two-way active infrared (IR) communications.
 - d. Configuration Tools: Handheld remote for room configuration 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 send and receive of room variables and store of occupancy sensor settings. Computer software also customizes room settings.

- e. Room Network - Digital Lighting Management (DLM) Local Network: Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
- f. Network Bridge: Provides BACnet MS/TP-compliant digital networked communication between rooms, panels, and the Segment Management or building automation system (BAS).
- g. Segment Manager: Provides web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting.
- h. 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.

D. Lighting Control Applications:

- 1. Unless relevant provisions of the applicable local Energy Codes are more stringent, provide a minimum application of lighting controls as follows:
 - a. Space Control Requirements: Provide occupancy/vacancy sensors with Manual-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 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.
 - b. Daylit areas: All luminaires within 15-feet of windows or within 7-feet of skylights (the daylit zones) will be controlled separately from luminaires outside of daylit zones. Luminaires closest to the daylight aperture will be controlled separately from luminaires farther from the daylight aperture, within the daylight zone.
 - c. Daytime setpoints for total ambient illumination (combined daylight and electric light) level that initiate dimming will be programmed to be not less than 125 percent of the nighttime maintained designed illumination levels.
 - d. Multiple-leveled switched daylight harvesting controls may be utilized for areas marked on Drawings.
 - e. 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.

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1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards per Division 01, General Requirements and Section 26 00 00, Electrical Basic Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

- B. In addition, provide:

1. Layout of sensors indicating their sensing distribution on reproducible Architectural Floor Plans.
2. Shop Drawings: Provide wiring diagrams indicating low voltage and line voltage wiring requirements for occupancy sensors, and each digital lighting control system shown on the electrical drawings.
3. Closeout Submittals:
 - a. Sustainable Design Closeout Documentation: Lighting Control System Manufacturer to provide Enhanced Start-up documentation that details the start-up procedure being performed including a process to follow, details on tests performed and an area that documents any test results.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 1. Manufacturer: Minimum 10 years experience in manufacture of architectural lighting controls.
 2. Manufacturer's Quality System: Registered to ISO 9001:2000 Quality Standard, including in-house engineering for product design activities.
 3. Lighting Control System Components: Listed by UL specifically for the required loads. Provide evidence of compliance upon request.
 4. Prior to adjusting and calibrating daylighting control system and local photocell field adjustable settings, contact local manufacturer representative and arrange for representative to visit site to educate both field installer and Owner's Authorized Representative on the operation of the controls.
 5. Use manufacturer's published testing and adjusting procedures to adjust sensors time delay, daylight sensitivity, and passive infrared sensitivity to satisfaction of Owner.

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6. Training: Provide minimum 4-hour training session to Owner's Authorized Representatives at a time approved by Owner after Owner has received approved operation and maintenance manuals. Training to include discussion of operation, adjustment, and replacement of sensors, photocells and control.
7. Prepare and complete report of test procedures and results. Submit these test procedures and results to Owner.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Wattstopper DLM Series
- B. Lutron Quantum Series
- C. Douglas Lighting Controls Dialog Series
- D. Acuity Controls
- E. Eaton Wavelinx
- F. Or approved equivalent.

2.2 GENERAL PERFORMANCE

- A. Daylight Harvesting and Occupant Detection to Control Lighting with the Following Hierarchy:
 1. Emergency (Highest Priority): Ignores all other inputs.
 2. Programming: During system programming, sensor inputs are ignored.
 3. Occupant Sensor: Allows lights to be on/off.
 4. Daylight Sensor: Imposes a high end limit for light output.
 5. Personal Control: Fine tune light levels up to the daylight sensor limit.
- B. Response to a single sensor can be unique on luminaire by luminaire basis.
- C. Power failure recovery - All devices return to their previous light level prior to power loss.
- D. All programmable devices with integral power failure memory to maintain settings for a minimum of 10 hours during power loss.
- E. Wall station and sensor replacement accomplished without programming.

2.3 DIGITAL WALL or CEILING MOUNTED OCCUPANCY SENSOR SYSTEM

- A. Wall or Ceiling mounted (to suit installation) dual technology digital (passive infrared and ultrasonic) occupancy sensor. Furnish the system accommodating the square-foot coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, and accessories which suit the lighting and electrical system parameters.
- B. Digital Occupancy Sensors will provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
 - 1. Digital calibration and pushbutton programming for the following variables:
 - a. Sensitivity: 0-100 percent in 10 percent 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. Two RJ-45 port(s) for connection to DLM local network.
 - 3. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
 - 4. Device Status LEDs including:
 - a. PIR Detection.
 - b. Ultrasonic detection.
 - c. Configuration mode.
 - d. Load binding.
 - 5. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
 - 6. Manual override of controlled loads.
- C. Units will not have any dip switches or potentiometers for field settings.
- D. 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.
- E. Wattstopper product number: LMDC-100 or LMDX-100.

2.4 DIGITAL WALL SWITCHES

- A. Low voltage momentary pushbutton switches in 1, 2, 3, and 4 button configuration; available in white, light almond, ivory, grey, and black; compatible with wall plates with decorator opening. Wall switches will include the following:
 - 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. Red configuration LED on each switch that blinks to indicate data transmission.
 - 4. Blue 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 will include seven bi-level LEDs to indicate load levels using 14 steps.
- B. Two RJ-45 ports for connection to DLM local network.
- C. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required to achieve multi-way switching.
- D. 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 Face 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 dependent; each button may be bound to multiple loads.
- E. Wattstopper product number: LMSW-101, LMSW-102, LMSW-103, or LMSW-104.

2.5 ROOM CONTROLLERS

- A. Room controllers automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room controllers shall be provided to match the room lighting load and control requirements. The controllers will be simple to install and will not

have, dip switches, potentiometers or require special configuration. 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 unit without requiring any configuration or setup.
 3. Device Status LEDs to indicate:
 - a. Data transmission.
 - b. Device has power.
 - c. Status for each load.
 - d. Configuration status.
 4. Quick installation features including:
 - a. Standard junction box mounting.
 - b. Quick low voltage connections using standard RJ-45 patch cable.
 5. Plenum rated.
 6. Manual override and LED indication for each load.
 7. Dual voltage (120/277 VAC, 60 Hz).
 8. Zero cross circuitry for each load.
- B. On/Off/Dimming Enhanced Room Controllers shall include:
1. Real time current monitoring.
 2. Three relay configuration.
 3. Efficient 250 mA switching power supply.
 4. Four RJ-45 DLM local network ports.
 5. One 0-10 volt analog output per relay for control of compatible LED drivers.
 6. Network Bridge for BACnet MS/TP communications (LMRC-3xx).
 7. The following dimming attributes may be changed or selected using a wireless configuration tool:
 - a. Establish preset level for each load from 0-100 percent.
 - b. Set high and low trim for each load.

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8. Discrete model listed for connection to receptacles, for occupancy-based control of plug loads within the space.
 - a. One relay configuration only.
 - b. Automatic ON/OFF configuration.
9. Wattstopper product number: LMRC-213.

2.6 ROOM NETWORK (DLM LOCAL 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. Digital room devices connect to the network using CAT 5e cables with RJ-45 connectors which provide both data and power to room devices. 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.

2.7 CONFIGURATIONS TOOLS

- A. A configuration tool facilitates optional customization of DLM local networks, and is used to set up open loop daylighting sensors. A wireless configuration tool features 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:
 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. Read, modify and send parameters for occupancy sensors, daylighting sensors, room controllers, and buttons on digital wall switches.
 4. Save up to nine 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.
 6. Adjust or fine-tune daylighting settings established during auto-commissioning, and input light level data to complete commissioning of open loop daylighting controls.
- C. Wattstopper product number: LMCT-100.

2.8 NETWORK BRIDGE

- A. The network bridge connects a DLM local network to a BACnet-compliant network for communication between rooms, 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.
1. The network bridge may be incorporated directly into the room controller hardware (LMRC-3xx Room Controllers) or 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 all 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. 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 the occupancy sensor.
 - c. Read/write the On/Off state of loads.
 - d. Read/write the dimmed light level of loads.
 - e. Read the button states of switches.
 - f. Read total current in amps, and total power in watts through the room controller.
 - g. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings.
 - h. Activate a preset scene for the room.
 - i. Read/write daylight sensor fade time and day and night setpoints.
 - j. Read the current light level, in footcandles, from interior and exterior photosensors and photocells.
 - k. Set daylight sensor operating mode.
 - l. Read/write wall switch lock status.
 4. Wattstopper product number: LMBC-300.

2.9 SEGMENT MANAGER

- A. 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

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a standard web browser. Each segment manager shall have support for one segment networks as required and allow for control of a maximum of 120 local networks (rooms) and/or lighting control panels per segment network.

- B. Operational features of the segment manager shall include the following:
1. Connection to PC or LAN via standard Ethernet TCP/IP.
 2. Easy to learn and use graphical user interface, compatible with Internet Explorer 11, or equal browser.
 3. Log in security capable of restricting some users to view-only or other limited operations.
 4. Automatic discovery of all DLM devices on the segment network(s). Commissioning beyond activation of the discovery function shall not be required.
 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.
 7. Ability to set up schedules for rooms and panels. Schedules shall automatically set controlled zones or areas to either a normal hours or after hours mode of operation.
 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 seamless integration with the BAS via BACnet IP.

- C. Wattstopper product number: LMSM-3E.

2.10 EMERGENCY LIGHTING

- 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.
 4. UL2043 plenum rated.
- B. Wattstopper product number: ELCU-100, with EMTS-100 remote test switch.

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2.11 SOURCE QUALITY CONTROL

- A. Perform full-function testing on all completed assemblies at end of line.
- B. Diagnostics and Service - Tiered control scheme for dealing with component failure that minimizes loss of control for occupant.
 - 1. Bus Failure: Lights go to emergency level for safety.
 - 2. Failure of One Sensor Type: Ballast still controllable via other sensors.
 - 3. Ballast Failure: Only impacts one fixture - remainder of system operates as programmed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install equipment in accordance with manufacturer's installation instructions and Contract Documents.
- B. Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.
- C. Install photocells as directed by manufacturer's instructions. Complete connections to control circuits, photocells, control modules, power supply pack and low voltage wiring.
- D. Verify with manufacturer's representative that sensors and photocells are laid out in compliance to manufacturer's published sensing distribution. Provide additional sensors for complete coverage of space being sensed.
- E. Photocell Placement and Wiring:
 - 1. Drawings are schematic, and show photocell quantities together with the daylighting zones that they control.
 - 2. Reference manufacturer installation instructions for the recommended location and orientation of photocell with respect to exterior glazing and both interior and exterior lighting.
 - 3. Ensure that daylight sensor placement minimizes sensors view of electric light sources; ceiling mounted and fixture-mounted daylight sensors shall not have direct view of luminaries.
 - 4. Reposition sensor at no additional cost to Owner to avoid conflict between sensor and object obscuring its view, and between sensor and both interior and exterior lighting that causes daylighting controls to repeatedly increase and decrease in brightness (i.e., "cycling").
 - 5. Field wire photocell for correct footcandle range.
- F. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
 - 1. Ambient temperature: 32 degrees F to 104 degrees F.

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2. Relative Humidity: Maximum 90 percent, non-condensing.
- G. Lighting control system must be protected from dust during installation.
- H. Prior to applying continuous dimming daylighting controls, maintain LED lighting at full output for a minimum of 100 hours. If this is not done, replace lamps and drivers of affected luminaires at no cost to Owner.
- I. Use manufacturer's published testing and adjusting procedures to adjust sensor time delay, daylight sensitivity, and passive infrared sensitivity to satisfaction of Owner.
- J. Systems Integration:
 1. Equipment Integration Meeting Visit: Owner's Authorized Representative to coordinate meeting with Lighting Control System Manufacturer and other related equipment manufacturers to discuss equipment and integration procedures.

3.2 STARTUP AND PROGRAMMING

- A. Provide factory-certified field service engineer to ensure proper system installation and operation under following parameters:
 1. Qualifications for Factory-Certified Field Service Engineer:
 - a. Minimum experience of two years training in the electrical/electronic field.
 - b. Certified by the equipment manufacturer on the system installed.
 2. Site Visit Activities:
 - a. Verify connection of power feeds and load circuits.
 - b. Verify connection of controls.
 - c. Verify system operation control by control, circuit by circuit.
 - d. Obtain sign-off on system functions.
 - e. Demonstrate and educate Owner's Authorized Representative on system capabilities, operation and maintenance.
- B. Tech Support: Provide factory direct technical support hotline 24 hours per day, seven days per week.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer Services:
 1. Aim and Focus Visit: Facility Representative to coordinate on-site meeting with Lighting Control System Manufacturer and Lighting Design Consultant to make required lighting adjustments to the system for conformance with the Lighting Design Consultant's original design intent.

3.4 CLOSEOUT ACTIVITIES

- A. Training Visit: Lighting Control System Manufacturer to provide one day additional on-site system training to site personnel no less than two months after Substantial Completion, separate from start-up and programming visit.
- B. On-Site Walk Through: Lighting Control System Manufacturer to provide a factory certified Field Service Engineer to demonstrate system functionality to the Commissioning Agent.
- C. Test lighting controls to ensure that control devices, components, equipment and systems are calibrated, adjusted and operate in accordance with Drawings and Specifications. Provide functional testing of sequences of operation to ensure operation in accordance with Drawings and Specifications. Provide complete report of test procedures and results to engineer and insert approved copy into project closeout documents.
- D. Testing Includes:
 - 1. Daylight automatic controls.
 - 2. Occupant sensing automatic controls.
 - 3. Automatic time and override controls for interior lighting.
 - 4. Automatic time and photo controls for exterior lighting.

3.5 MAINTENANCE

- A. Capable of providing on-site service support within 24 hours as part of Warranty and Maintenance Plan.
- B. Offer renewable service contract on yearly basis, to include parts, factory labor, and annual training visits. Make service contracts available up to ten years after date of system startup separate from Construction Contract.
- C. System Optimization Visit: Lighting Control System Manufacturer to visit site six months after system start-up to evaluate system usage and discuss opportunities to make efficiency improvements that will fit with the current use of the facility.

END OF SECTION

SECTION 26 2200
LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Two-Winding Transformers

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. UL 1561: Dry-Type General Purpose and Power Transformers.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Production test each unit according to NEMA Standard 20.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Schneider Electric/Square D
- B. Basis of Design: Eaton
- C. ABB/General Electric
- D. Siemens

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- E. Or approved equivalent.
- F. Basis of Design: Eaton. Manufacturers listed are allowed on condition of meeting specified conditions including available space for equipment and Code required working clearances. Remove and replace equipment installed that does not meet these conditions at no cost to Owner.

2.2 TWO-WINDING TRANSFORMERS

- A. Description: Factory assembled, air cooled dry type transformer. Efficiency compliant with Federal Code 10 CFR Part 431 and DOE 2016 efficiency requirements. NEMA TP-1 efficiency levels are not acceptable.
- B. Primary Voltage: 480 volts, 3 phase.
- C. Secondary Voltage: 208Y/120 volts, 3 phase.
- D. Windings: Aluminum.
- E. Insulation system and average winding temperature rise for rated kVA as follows:
 - 1. 16-500 kVA: Class 220 with 115 degrees C rise.
- F. Maximum Winding Temperature: Do not exceed 30 degrees C rise above 40 degrees C ambient at warmest point at full load.
- G. Winding Taps:
 - 1. Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
 - 2. Transformers 15 kVA and Larger: NEMA ST 20.
- H. Conductor Termination Lugs: Compression.
- I. Sound Levels: NEMA ST 20.
- J. Basic Impulse Level: 10 kV.
- K. Impedance: 3 to 5 percent, unless otherwise noted on drawings. Minimum reactance 2 percent.
- L. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- M. Mounting:
 - 1. Larger than 75 kVA: Suitable for floor mounting.
- N. Coil Conductors: Continuous windings with terminations brazed or welded.
- O. Transformer Enclosure: NEMA ST 20.
 - 1. Interior: Type 1.
 - 2. Ventilated.

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3. Provide lifting eyes or brackets.
- P. Isolate core and coil from enclosure using vibration-absorbing mounting pads.
- Q. Nameplate: Reference Section 26 05 53, Identification for Electrical Systems.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Set transformers plumb and level.
- B. Use flexible conduit, 2-feet minimum length with slack, for connections to transformer case. Make conduit connections to side panel of enclosure.
- C. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by manufacturer. Mount to allow a minimum of 6-feet, 6-inches headroom below unit.
- D. Mount trapeze-mounted transformers as indicated.
- E. Provide grounding and bonding in accordance with Section 26 05 26, Grounding and Bonding of Electrical Systems.
- F. Clearance: Minimum 6-inches clear on sides and back. Front clearance per NEC 110.26. Maintain minimum clearance from combustible materials per NEC. Comply with manufacturers recommendations.
- G. Exterior Installations: Weather resistant enclosure.
 1. Provide 8-inches diameter by 24-inches (above and below grade) concrete filled steel bollards where subject to vehicular traffic.
 2. Where grouped with switchgear refinish as required so that transformers and switchgear match in color.
- H. Unacceptable Humming and Noise Levels: Revise installation as required to achieve a noise level less than or equal to those defined in NEMA ST-20 for associated transformer size or replace with a new unit with an acceptable sound level.
- I. Provide Concrete Housekeeping Pad:
 1. Interior Pads: Extend pad 4-inches beyond transformer width and depth dimensions. Top of pad minimum 3-inches above finish floor. Install pad plumb and level.
 2. Exterior Pads: Provide concrete pads of 2,500 to 3,000 PSI concrete reinforced with 8 gauge wire fabric or No. 6 reinforcing bars on 12-inch centers. Provide 10-inch thick base of gravel below pad for support. Pad extends 6-inches on all sides from exterior most prominent dimension. Provide 3/4-inch by 10-foot ground rod at each corner bonded to No. 2 AWG bare copper grounding conductor, bonded to transformer and concrete reinforcement.
 3. Housekeeping pads provided under provisions of Division 03, Concrete.
- J. Provide equipment nameplates per Section 26 05 53, Identification for Electrical Systems.

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- K. Provide arc flash labels per Section 26 05 73, Electrical Distribution System Studies.

3.2 FIELD QUALITY CONTROL

- A. Perform field inspection, testing, and adjusting.
- B. Perform inspections and tests listed in accordance with manufacturers requirements. In addition including following:
 1. Perform turns ratio tests at tap positions.
 2. Verification that as-left tap connections are as specified.
 3. Perform excitation-current tests on each phase.
 4. Measure resistance of each winding at each tap connection.
 5. Overpotential test on high- and low-voltage windings-to-ground.
- C. Check for damage and tight connections prior to energizing transformers.

3.3 ADJUSTING

- A. Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION

SECTION 26 2413
SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Switchboards
 - 2. Commercial Metering Switchboards
 - 3. Non-Utility Power Meters (Microprocessor-Based Metering Equipment)

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
 - 1. Section 26 05 73, Electrical Distribution System Studies.
 - 2. Section 26 28 00, Overcurrent Protective Devices.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. UL 891, Standards for Switchboards.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Operation and Maintenance Manuals:
 - a. After completion of work and start-up of the equipment at the project site, deliver to the Owner's Authorized Representative operation instructions, maintenance manuals and drawings presenting full details for care and maintenance of each item of equipment provided under this Contract. Number of copies in accordance with Division 01.
 - b. Each copy to contain the operating and maintenance information and parts lists for equipment provided under this Contract. When necessary, provide supplemental drawings to show system operation and servicing maintenance points. For electrical components, provide wiring and connection diagrams. Include instructions required to accomplish specified operation and functions. Data to be neat, clean and legible.

- c. Switchboard drawings and wiring diagrams to be included and up to date at the completion of start-up and system acceptance by the Owner. Drawings and wiring diagrams to include any field modifications or changes to reflect actual as-installed conditions.
- d. In general, the manual to include, but not necessarily be limited to, the following:
 - 1) Switchboard Elevation and One Line.
 - 2) AC and DC Schematic and Physical Component Layout Drawings.
 - 3) Remote Interface Drawing.
 - 4) Bill of Material.
 - 5) Description of Operation.
- e. Provide manuals in accordance with Division 01 adequately labeled with the project name and location and the contents indexed.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Switchboards
 - 1. Basis of Design: Eaton
 - 2. GE Industries
 - 3. Siemens
 - 4. Schneider Electric/Square D
 - 5. Or approved equivalent.
- B. Commercial Metering Switchboards
 - 1. Basis of Design: Eaton
 - 2. GE Industries
 - 3. Siemens
 - 4. Schneider Electric/Square D

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5. Or approved equivalent.
- C. Non-Utility Power Meters (Microprocessor-Based Metering Equipment)
 1. Basis of Design: Eaton
 2. GE Industries
 3. Siemens
 4. Schneider Electric/Square D
 5. Or approved equivalent.
- D. Manufacturers listed above are allowed on condition of meeting specified conditions including available space for equipment, Code required working clearances, selective coordination per Section 26 05 73, Electrical Distribution System Studies, and amps interrupting capacity (AIC) per short circuit study in Section 26 05 73, Electrical Distribution System Studies. Prior to submitting bid, manufacturer to provide documentation to Engineer verifying specific conditions, including those mentioned above, can be met. Remove and replace electrical equipment installed, at no cost to the Owner, that does not meet these conditions.

2.2 SWITCHBOARDS

- A. Description: NEMA PB 2 freestanding switchboard with electrical ratings and configurations as indicated and specified.
- B. Integrated Equipment Rating: Provide fully rated integrated equipment rating greater than the available fault current. Series rated switchboards are not acceptable. Reference drawings for available fault current. If drawings do not have available fault current shown, then coordinate with serving electrical utility.
- C. Enclosure to be suitable for having 100 percent rated circuit breakers installed and applied at 100 percent. Enclosure to meet minimum size and ventilation requirements set forth on the 100 percent circuit breaker or must be UL tested for 100 percent rating of the circuit breaker.
- D. Bus Material: Copper, standard size.
- E. Ground Bus: Extend length of switchboard, 50 percent of phase bus capacity.
- F. Neutral Bus: 100 percent rated, full length of switchboard.
- G. Lugs: Mechanical type for copper conductors.
- H. Fusible Switch Assemblies: NEMA KS 1, quick make, quick break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Provide fuse rejection feature for Class R fuses up to 600 amp.
 1. Provide switches of 30 to 200 amp with plug-on line side connections.
- I. Fusible Switch Assemblies, 800 Amperes and Larger: Bolted pressure contact switches. Fuse clips: Designed to accommodate Class L fuses. Provide with shunt trip and ground fault capabilities.

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- J. Molded Case Circuit Breakers: Integral thermal and instantaneous magnetic trip in each pole.
1. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
 2. Include shunt trip where indicated.
- K. Circuit breakers 1200 Amp and Greater: Provide breaker with energy-reducing maintenance switching with local status indicator per CEC Article 240.87(B).
- L. Metering Transformer Compartment: For utility company's use; compartment size, bus spacing and drilling, door, and locking and sealing requirements in accordance with utility company's requirements.
- M. Utility Pull Section:
1. Width as shown on drawings. Depth and height to match switchboard.
 2. Arrange as shown on drawings.
- N. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.
- O. Pull Box: Removable top and sides, same construction as switchboard.
1. Size as shown on drawings.
 2. Provide insulating, fire-resistive bottom with separate openings for each circuit to pass into switchboard.
- P. Enclosure: NEMA Type 1 - Indoor.
1. Align sections as shown on drawings.
 2. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.
 3. Removable front covers: Screw attached.
 4. Provide removable hinge pins on hinged doors.
 5. Provide full height barriers between sections.
- 2.3 COMMERCIAL METERING SWITCHBOARDS
- A. Comply with requirements of 2.02 above.
 - B. Tested and UL Listed for use as multi-metering system.
 - C. Meet EUSERC requirements.
 - D. Integrated Equipment Rating: Provide fully rated integrated equipment rating greater than the available fault current. Series rated switchboards are not acceptable. Reference drawings for available fault current. If drawings do not have available fault current shown, then coordinate

with serving electrical utility.

E. Meter Sockets/Branch Devices:

1. Provide meter sockets per utility company requirements.
2. Small tenant metering section
 - a. Cold and hot sequences (hot is default)
 - b. Tenant disconnects (60 amps up to 200 amps), circuit breaker or fusible pullout
 - c. 3-pole, 2-pole disconnects
 - d. Provisions for field installable socket and breaker additions
 - e. 5 or 7 jaw sockets
 - f. 3-socket meter section, 6-socket meter section
 - g. Sockets rated at 200 amp continuous duty
3. Large tenant metering section (400 amps up to 1200 amps)
 - a. Hot sequence metering
 - b. Tenant disconnect (400 amps up to 1200 amps), circuit breaker or fusible pullout
 - c. 3-pole disconnect
 - d. 13 jaw socket
 - e. Mounting provisions for CTs
 - f. Transformer rated meter socket
4. Prewired circuit breaker branch device meter socket combination.
5. Provide thermostatically controlled electric heaters in each section, sized to prevent condensation under expected weather conditions at project site.
6. Provide terminals for separate connection of heater power circuit.

F. Circuit breakers 1200 Amp and Greater: Provide breaker with energy-reducing maintenance switching with local status indicator per CEC Article 240.87(B).

2.4 NON-UTILITY POWER METERS (MICROPROCESSOR-BASED METERING EQUIPMENT)

A. Power Xpert Branch Circuit Monitor

1. The main breaker meter shall be Eaton PowerXpert 4000 or approved equal.
2. Sub breaker meters shall be Eaton Power IQ 250 or approved equal.
3. Power meters shall have certified revenue accuracy as per ANSI C12.20 and IEC 60687 class 0.5S or better.

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4. The meter and associated instrument transformers shall provide accuracy of +/- 1 percent over the range of 5 percent to 100 percent of rated current or voltage, +/- 2 percent over the range of 5 percent to 100 percent of rated power.
5. Where shown on the drawings, supply a UL listed microprocessor-based Branch Circuit Monitoring System (PXBCM), or approved equal having the specified features. This system shall consist of meter base, and meter module(s) as described below.
6. The Branch Circuit Monitor shall measure the following operational data for up to 84 branch load circuits:
 - a. Forward and Reverse kWh.
 - b. Watts, VA, Amps, Power Factor.
 - c. Present and Peak demand readings for Amps, Forward and Reverse Watts.
 - d. Maximum Watts, VA, Amps.
7. The Branch Circuit Monitor shall support alarms for current that can be set based on percent of breaker rating and alarms for voltage based on percent of nominal voltage.
 - a. High, High-High, Low, Low-Low non-latching alarms for current.
 - b. High and Low latching alarms for current, resettable via Modbus or the WEB interface.
 - c. High and Low latching and non-latching voltage alarms for each meter module input voltage.
 - d. Alarm Status and alarm counters shall be available via Modbus communications.
8. Branch Circuit monitor shall support upgradeable firmware via communications.
9. The Branch Circuit Monitor shall have the following ratings:
 - a. Elevation: 0 to 9843 ft (0 to 3000M).
 - b. Pollution degree: 2 (IEC 60644-1).
 - c. Ambient temperature range: -20 degrees C to +70 degrees C (-4 degrees to +158 degrees F).
 - d. Storage temperature range: -40 degrees C to +85 degrees C (-40 degrees F to +185 degrees F).
 - e. Humidity: 5 percent to 95 percent non-condensing.
 - f. PXBCM as a component shall have a NEMA 1 rating. When installed in an enclosure it shall have the same rating as its enclosure NEMA 1.
 - g. Housing Ingress Protection: IP20 as a component, in an enclosure the same as the enclosure.
 - h. CE Mark.

- i. EMC (Electromagnetic Compatibility):
 - 1) IEC61326: EMI IEC61000-4-X Level 3.
 - 2) CISPR 11: Class B emissions, CISPR 22 (Ethernet) class B emissions.
 - 3) FCC Part 15 Class B emissions.
 - j. UL/cUL 61010-1 3rd Edition.
 - k. EN61010-1.
10. PXBCM Meter Base:
- a. Each PXBCM-MB Meter Base shall support connection of up to 4 Meter Modules in either a MMS Strip or MME External configuration monitoring a total of up to 100 single-phase two-wire AC loads, 48 single-phase three-wire AC loads or 32 three-phase four-wire AC loads or combinations not to exceed 25 poles per meter module.
 - b. The PXBCM-MB shall be equipped with 4 meter module ports. Each port shall provide control power and communications to either a PXBCM-MMS Meter Module Strip or a PXBCM-MME Meter Module External with a maximum cable length of 28 feet between each Meter Base and each Meter Module.
 - c. Each PXBCM-MB shall support connection to up to 4 PXBCM-MMS Meter Module Strip or 4 PXBCM-MME Meter Module External, or a combination of up to 4 total PXBCM-MMS and PXBCM-MME each meter module with independent single or three phase voltage metering circuits with inputs up to 277V L-N and 480V L-L.
 - d. PXBCM-MB Power Supply shall be rated for 100-277VAC L:N +/-10% CAT III, 47-63 Hz , 6W.
 - e. The PXBCM-MB shall include a 3 terminal RS-485 serial port for Modbus RTU communications and an RJ-45 port for Ethernet communications. The Ethernet port shall support Modbus TCP communications as well as an Embedded WEB server.
 - f. The PXBCM-MB embedded WEB server shall support device configuration for up to 4 PXBCM-MMS Meter Module Strip or 4 PXBCM-MME Meter Module External, or a combination of up to 4 total PXBCM-MMS and PXBCM-MME and display of up to 100 points of metering data. It shall be possible to save device configuration information to a file for archiving and for uploading to PXBCM.
 - g. The PXBCM-MB shall support connection to a pre-configured HMI via RS-485 serial port. The HMI shall not require configuration.
 - h. The PXBCM-MB shall be equipped with LEDs to indicate communications activity and Device/Alarm Status. An LED shall also indicate if Ethernet is configured for DHCP (automatically assigned IP address) or Fixed IP (manually assigned IP address). The PXBCM-MB shall be equipped with 2 rotary switches to assign Modbus Slave ID 1-99.

- i. The PXBCM-MB shall be equipped with security mode switches to enable the device to operate in a secure mode to prevent tampering with device configuration and resets over comms.
 - j. The PXBCM Meter Base shall automatically sense the type of PXBCM Meter Module connected to each of its 4 meter module ports.
 - k. The Configuration Wizard shall support naming and configuration of up 100 virtual meters by assigning 1-3 channels of current to 1, 2 or 3 pole meters. Virtual meters shall aggregate the channel data assigned to each virtual meter and report the aggregated virtual meter values for:
 - 1) Forward and Reverse Energy.
 - 2) Watts, VA, Average Amps and Power Factor.
 - 3) Average and Peak demand for Watts and VA.
11. PXBCM-MMS Meter Module Strip:
- a. PXBCM-MMS Meter Module Strips shall be available in configurations to mount on either the left or right of a panelboard and contain 9, 15, or 21 CTs. Four additional 333mV connections shall be provided on each PXBCM-MMS for Auxiliary 333mV CT connections which can be used to monitor the panel mains or branch circuits. The MMS shall include both load current and voltage metering circuits providing meter data to the Meter Base.
 - b. The PXBCM Meter Module Strip shall be available with either 9 CTs, 15 CT's or 21 CT's per assembly for factory assembly into Panelboards with 18, 30 or 42 poles. PXBCM MMS CTs shall have be rated for up to 100A continuous current monitoring and designed to mount in an Eaton PRL-1a, PRS-2a or PRL-3e Panelboard with 1 inch breaker pole spacing.
 - c. PXBCM Meter Module Strip 1 inch center CTs shall have a window opening sufficient for insulated Aluminum conductor rated for 100A capacity.
 - d. The PXBCM Meter Module Strip shall support direct connection of one set of 3 phase nominal metering voltage inputs up to 277V L-N and 480V L-L voltages and shall be rated as Cat III.
 - e. The Meter Modules can also monitor voltage in the following configurations:
 - 1) Three phase, four wire wye.
 - 2) Three phase, three wire delta.
 - 3) Three phase, center tapped delta.
 - 4) Three phase, three wire.
 - 5) Single phase, two wire.
 - f. Power and Energy metering shall be performed based on the voltage assignment for each 100A strip mounted CT and 333mV Aux CT current input as configured

using the embedded WEB server.

- g. PXBCM MMS Accuracy of kWh metering on branch circuits shall be rated for ANSI C12.20 0.5 accuracy class as a system, including 100A rated strip mounted solid core current transformers. kWh accuracy for 333mV input auxiliary circuits shall satisfy ANSI C12.20 0.5 class excluding external 333mV sensor performance.
 - h. The PXBCM MMS shall be UL approved for mounting to the panelboard interior with no interference. Strip placement shall line up 1 inch center CT's with breaker poles and not impede the normal routing of branch circuit conductors in the panel enclosure.
 - i. The PXBCM MMS shall connect to the PXBCM MB using factory supplied cables.
12. PXBCM-MME Meter Module External:
- a. The PXBCM-MME provides the same metering functionality as the PXBCM-MMS but is used for retrofit or non-uniform/high-mix load applications where the PXBCM-MMS strip mounted 100A CT's cannot be applied.
 - b. The PXBCM Meter Module external shall support 25 channels of current using external 333mV current sensors connected to terminal strips on the PXBCM-MME.
 - c. The PXBCM Meter Module External shall support direct connection of one set of 3 phase nominal metering voltage inputs up to 277V L-N and 480V L-L voltages and shall be rated as Cat III.
 - d. The Meter Modules can also monitor voltage in the following configurations:
 - 1) Three phase, four wire wye.
 - 2) Three phase, three wire delta.
 - 3) Three phase, center tapped delta.
 - 4) Three phase, three wire.
 - 5) Single phase, two wire.
 - e. Power and Energy metering shall be performed based on the voltage assignment for each 333mV current sensor input as configured using the embedded WEB server.
 - f. PXBCM MMS Accuracy of kWh metering on 333mV input circuits shall satisfy ANSI C12.20 0.5 class excluding external 333mV sensor performance.
13. Optional HMI Display shall display data for all configured sub-meters.
- a. HMI configuration shall not be required for each sub-meter. The HMI shall discover the configuration information automatically.
 - b. Displayed information shall include:

- 1) Sub-meter name, current, voltage, energy consumption, demand, and power factor for up to 100 load circuits.
- 2) Aggregated Power and Energy readings for any 1, 2 or 3 pole meters.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Provide concrete housekeeping pad. Extend 6-inches beyond switchboard width and depth dimensions. Minimum 3-inches above finished floor. Install plumb and level.
- B. Verify that field measurements are as indicated on Shop Drawings.
- C. Install in a neat and workmanlike manner and in location shown on Drawings, according to NEMA PB 2.1.
- D. Adjust all operating mechanisms for free mechanical movement.
- E. Tighten bolted bus connections in accordance with manufacturer's instructions.

3.2 SWITCHBOARDS INSTALLATION

- A. Shop inspect and test switchboard according to NEMA PB 2.
- B. Make completed switchboard available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner at least 7 days before inspection is allowed.
- C. Install switchboard in accordance with manufacturer's installation instructions.
- D. Tighten accessible bus connections and mechanical fasteners after placing switchboard.
- E. Provide arc flash labels per Section 26 05 73, Electrical Distribution System Studies.
- F. Provide engraved nameplates per Section 26 05 53, Identification of Electrical Systems.
- G. Provide fuses in each switch.
- H. Perform field inspection and testing.
- I. Perform inspections and tests listed in NETA STD ATS, Section 7.1.
- J. Measure, using a Megger, insulation resistance of each bus section phase-to-phase and phase-to-ground for one minute each, at minimum test voltage of 1000 Vdc; minimum acceptable value for insulation resistance is 1 megohms.
- K. Check tightness of accessible bolted bus joints using calibrated torque wrench per manufacturers recommended torque values.
- L. Physically test key interlock systems to check for proper functionality.
- M. Test ground fault systems by operating push-to-test button.
- N. Shunt Trip Circuit Breakers: Provide wiring to remote trip switch/contacts as indicated on Drawings.

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- O. Adjust circuit breaker trip and time delay settings to values indicated.
- P. Adjust circuit breaker trip and time delay settings to values as instructed by Engineer.
- Q. Clean exterior and interior of switchboard in accordance with manufacturers installation instructions.
- R. Vacuum construction dust, dirt, and debris out of switchboard interior.
- S. Where enclosure finish is damaged, touch up finish with matching paint in accordance with manufacturer's specifications and installation instructions.

3.3 COMMERCIAL METERING SWITCHBOARDS INSTALLATION

- A. Shop inspect and test switchboard according to NEMA PB 2.
- B. Make completed switchboard available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner at least 7 days before inspection is allowed.
- C. Install switchboard in accordance with manufacturer's installation instructions.
- D. Tighten accessible bus connections and mechanical fasteners after placing switchboard.
- E. Provide arc flash labels per Section 26 05 73, Electrical Distribution System Studies.
- F. Provide engraved nameplates per Section 26 05 53, Identification of Electrical Systems.
- G. Provide fuses in each switch.
- H. Perform field inspection and testing.
- I. Perform inspections and tests listed in NETA STD ATS, Section 7.1.
- J. Measure, using a Megger, insulation resistance of each bus section phase-to-phase and phase-to-ground for one minute each, at minimum test voltage of 1000 Vdc; minimum acceptable value for insulation resistance is 1 megohms.
- K. Check tightness of accessible bolted bus joints using calibrated torque wrench per manufacturers recommended torque values.
- L. Test ground fault systems by operating push-to-test button.
- M. Provide common multiple meter unit cabinet with blank spaces where multiple meters are mounted as shown on one-line diagram and/or floor plans (e.g., 8 meter cabinet with 3 blank spaces where 5 meters are shown in common location).
- N. Adjust circuit breaker trip and time delay settings to values indicated.
- O. Adjust circuit breaker trip and time delay settings to values as instructed by Engineer.
- P. Clean exterior and interior of switchboard in accordance with manufacturers installation instructions.
- Q. Vacuum construction dust, dirt, and debris out of switchboard interior.

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- R. Where enclosure finish is damaged, touch up finish with matching paint in accordance with manufacturer's specifications and installation instructions.

**3.4 NON-UTILITY POWER METERS (MICROPROCESSOR-BASED METERING EQUIPMENT)
INSTALLATION**

- A. Perform field inspection and testing.
- B. Perform inspections and tests listed in NETA STD ATS, Section 7.1.
- C. Measure, using a Megger, insulation resistance of each bus section phase-to-phase and phase-to-ground for one minute each, at minimum test voltage of 1000 Vdc; minimum acceptable value for insulation resistance is 1 megohms.
- D. Check tightness of accessible bolted bus joints using calibrated torque wrench per manufacturers recommended torque values.
- E. Provide cabling between current and voltage sensors and meter display enclosure.
- F. Provide device label for each meter per Section 26 05 53, Identification for Electrical Systems, listing load monitored (e.g., "Panel A", "Chiller # 3, etc). Use red label with white lettering where load is on generator backup.
- G. Provide common multiple meter unit cabinet with blank spaces where multiple meters are mounted as shown on one-line diagram and/or floor plans (e.g., 8 meter cabinet with 3 blank spaces where 5 meters are shown in common location).
- H. Provide cabling between meter display enclosure and auxiliary device for communication to energy management system.
- I. Provide ModBus cabling between meters, and from meter to energy management system.
- J. Provide a minimum of 4 hours of video recorded training for Owner on use of non-utility meters.

END OF SECTION

SECTION 26 2416
PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Power Distribution Panelboards
2. Panelboards

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 26 05 73, Electrical Distribution System Studies.
2. Section 26 24 13, Switchboards.
3. Section 26 28 00, Overcurrent Protective Devices.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. UL 67, Standards for Panelboards.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Power Distribution Panelboards:

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1. Basis of Design: Eaton
 2. ABB/General Electric
 3. Siemens
 4. Schneider Electric/Square D
 5. Or approved equivalent.
- B. Panelboards:
1. Basis of Design: Eaton
 2. ABB/General Electric
 3. Siemens
 4. Schneider Electric/Square D
 5. Or approved equivalent.
- C. Manufacturers listed above are allowed on condition of meeting specified conditions including available space for equipment, Code required working clearances, selective coordination per Section 26 05 73, Electrical Distribution System Studies, and amps interrupting capacity (AIC) per short circuit study in Section 260573, Electrical Distribution System Studies. Prior to submitting bid, manufacturer to provide documentation to Engineer verifying specific conditions, including those mentioned above, can be met. Remove and replace electrical equipment installed, at no cost to the Owner, that does not meet these conditions.

2.2 POWER DISTRIBUTION PANELBOARDS

- A. Description: NEMA PB 1 Type 1 or as indicated on drawings, circuit breaker type.
- B. Integrated Equipment Rating: Provide fully rated integrated equipment rating greater than the available fault current. Series rated panelboards are not acceptable. Reference drawings for available fault currents. If drawings do not have available fault current shown, then coordinate with serving electrical utility.
- C. Panelboard Bus: Non-reduced copper, ratings as indicated on drawings. Bus bar with suitable electroplating (tin) for corrosion control at connection. Provide copper ground bus in each panelboard.
- D. Lugs: Mechanical type for both aluminum and copper conductors. All device terminals/lugs shall be rated for a minimum of 75 degrees C to facilitate the use of 75 degrees C conductor ampacity rating.
- E. Molded Case Circuit Breakers: With integral thermal and instantaneous magnetic trip in each pole; UL listed. For air conditioning equipment branch circuits provide circuit breakers UL listed as Type HACR.
- F. Molded Case Circuit Breakers with Current Limiters: With replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole; UL listed.

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- G. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.
- H. Fully equip unused spaces for future devices, including manufacturer required connections and mounting hardware.
- I. Cabinet Front: Surface type hinged door with flush lock, metal directory frame, finished in manufacturer's standard gray enamel.

2.3 PANELBOARDS

- A. Description: Panelboards 400 amps or less. NEMA PB1, Type 1 or as indicated on drawings, circuit breaker type. Maximum enclosure depth: 6-inches for surface mounted, 5-3/4-inches for flush mounted.
- B. Maximum Width: 20-inches.
- C. Integrated Equipment Rating: Provide fully rated integrated equipment rating greater than the available fault current. Series rated panelboards are not acceptable. Reference drawings for available fault current. If drawings do not have available fault current shown, then coordinate with serving electrical utility.
- D. Panelboard Bus Non-Reduced: Copper, ratings as indicated on drawings. Bus bar with suitable electroplating (tin) for corrosion control at connection. Provide copper ground bus in each panelboard.
- E. Lugs: Mechanical type for both aluminum and copper conductors. All device terminals/lugs shall be rated for a minimum of 75 degrees C to facilitate the use of 75 degrees C conductor ampacity rating.
- F. Provide double lugs and/or feed-through lugs for feed through feeders.
- G. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for poles; UL listed. Predrill bus for bolt-on breakers.
 - 1. Type SWD for lighting circuits.
 - 2. Type HACR for air conditioning equipment circuits.
 - 3. Class A ground fault interrupter circuit breakers where scheduled.
 - 4. Class B ground fault equipment protection circuit breakers for heat trace and other circuits as required by Code. Provide shunt trip circuit breakers where scheduled; provide wiring to remote trip switch/contacts as indicated on Drawings.
 - 5. Do not use tandem circuit breakers.
- H. Accessories: Provide where indicated: shunt trip, Class A ground fault circuit interrupter (GFCI), auxiliary switch, and alarm switch.
- I. Cabinet Front: Provide flush or surface mounting as shown on the schedules, drawings, or otherwise noted. Cabinet front with concealed hinged front cover construction, metal directory frame with heavy clear plastic protector, flush lift latch and lock, two keys per panel all keyed alike.

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- J. Provide boxes with removable blank end walls and interior mounting studs. Provide interior support bracket for ease of interior installation.
- K. Furnish surface mounted cabinet boxes without knockouts.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Install panelboards in accordance with NEMA PB 1.1, NECA 1 and manufacturers installation instructions.
- B. Install panelboards level and plumb. Install recessed panelboards flush with wall finishes.
- C. Height: 6-feet 6-inches to top of panelboard; install panelboards taller than 6-feet 6-inches with bottom no more than 4-inches above floor.
- D. Provide filler plates for unused spaces in panelboards.
- E. Provide typed circuit directory for each branch circuit panelboard. Include all "spaces" and "spares." Revise directory to reflect circuiting changes and as-installed conditions. Use final Owner designated room names and numbers, and not designations shown on drawings.
- F. Provide engraved plastic nameplates per Section 26 05 53, Identification for Electrical Systems.
- G. Provide arc flash labels per Section 26 05 73, Electrical Distribution System Studies.
- H. Provide concrete housekeeping pad for floor-mounted distribution panelboards. Extend 6-inches beyond distribution panel width and depth dimensions. Minimum 3-inches above finished floor. Install plumb and level.
- I. Provide two 1-inch spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.
- J. Provide permanent identification number in or on panelboard dead-front adjacent to each breaker pole position. Horizontal centerline of numbers to correspond with centerline of circuit breaker pole position.
- K. Ground and bond panelboard enclosure per NEC.
- L. Paint:
 - 1. Standard factory finish unless noted otherwise.
 - 2. Panelboards located in finished interior areas in view of building occupants; paint to match adjacent wall surface. Color and paint preparation as specified by Architect. Covers to be painted off wall, then installed over dried, painted wall surface.
- M. Provide handle guards on each circuit supplying obviously constant loads such as fire alarm, security, lighting controls, refrigerators and freezers, fire protection, etc.
- N. Provide interior wiring diagram, neutral wiring diagram, UL label, and short circuit rating on interior or in booklet format inserted in sleeve inside panel cover.

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- O. Verify available recessing depth and coordinate wall framing with other divisions.
- P. Maintain fire rating of wall where panels are installed flush in fire rated walls.
- Q. Perform inspections and tests in accordance with manufacturer's requirements.
- R. Thoroughly clean exterior and interior of each panelboard in accordance with manufacturer's installation instructions.
- S. Vacuum construction dust, dirt, and debris out of each panelboard.
- T. Where enclosure finish is damaged, touch up finish with matching paint in accordance with manufacturer's specifications and installation instructions.
- U. Reference Section 26 08 05, Electrical Acceptance Testing for testing requirements.

3.2 POWER DISTRIBUTION PANELBOARDS INSTALLATION

- A. Breakers being added to existing panelboards: Coordinate breaker type and short circuit rating with existing panelboard. Breakers to match existing in manufacturer's type and AIC rating. Provide new typed circuit directory.
- B. Provide handle tie to branch circuit breakers of multiwire branch circuits for simultaneous disconnection of circuits. Handle tie will be identified for use with circuit breakers provided. Reconfigure assigned circuits as necessary so that circuit breakers associate with multiwire branch circuits are physically adjacent, record changes in panelboard schedules and circuiting plans for record drawings.
- C. Shunt Trip Circuit Breakers: Provide wiring to remote trip switch/contacts as indicated on Drawings.
- D. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

3.3 PANELBOARDS INSTALLATION

- A. Breakers being added to existing panelboards: Coordinate breaker type and short circuit rating with existing panelboard. Breakers to match existing in manufacturer's type and AIC rating. Provide new typed circuit directory.
- B. Provide handle tie to branch circuit breakers of multiwire branch circuits for simultaneous disconnection of circuits. Handle tie will be identified for use with circuit breakers provided. Reconfigure assigned circuits as necessary so that circuit breakers associate with multiwire branch circuits are physically adjacent, record changes in panelboard schedules and circuiting plans for record drawings.
- C. Shunt Trip Circuit Breakers: Provide wiring to remote trip switch/contacts as indicated on Drawings.
- D. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

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END OF SECTION

Berkeley Fire Department Warehouse

Berkeley, CA

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SECTION 26 2713
ELECTRICAL METERING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Utility Metering Equipment
2. Energy Metering

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:

1. Utility Metering Equipment

a. Meter Base:

- 1) Circle AW.
- 2) Or approved equivalent.

b. Metering Equipment Enclosure:

- 1) ABB/General Electric

- 2) Schneider Electric/Square D
- 3) Eaton Electrical
- 4) Siemens
- 5) Or approved equivalent.

2. Energy Metering

- a. E-Mon D-Mon Class 2000D or 3000 with ModBus Communications Series.
- b. Or approved equivalent.

2.2 UTILITY METERING EQUIPMENT

- A. Meter Base: Surface or Flush mounted meter socket enclosure. Provide meter base(s) for energy/demand and reactive energy/demand bases as required by serving electric utility.
- B. Terminal Cabinet: Provide terminal cabinet that meets serving utility company's requirements. Construct as an integral part of main distribution switchboard.
- C. Provide fault withstand rating greater than utility determined available fault current.
- D. C.T. Enclosure: Provide enclosure that meets serving utility company's requirements. Construct as an integral part of main distribution switchboard.

2.3 ENERGY METERING

- A. Provide fully electronic meter with cycling 8-digit LCD display for energy consumption (kWh), current and peak load (kW). Meter includes rate of consumption indication and segment test button to ensure integrity of display.
- B. Energy Consumption: Meter to indicate real time power consumption levels for field-testing and certification. Manually reset to zero.
- C. Enclosure: Heavy duty JIC steel enclosure suitable for indoor installation, lockable for preventing unauthorized access.
- D. Operating Parameters:
 - 1. Voltage: Up to 600 volts rms AC available.
 - 2. Current: Up to 3200 amps rms AC available.
 - 3. Power Factor: 0.5 lagging to 0.5 leading.
 - 4. Frequency: 50 to 60 Hz.
 - 5. Voltage Operating Range: Plus or minus 25 percent of rated voltage.
 - 6. Temperature Range: Minus 20C to plus 50C.
 - 7. Humidity: 0 to 95 percent non-condensing.

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8. Voltage Overload: Plus 25 percent continuous, plus 100 percent for 20 cycles.
9. Current Overload: Plus 100 percent without damaging meter.
- E. Current and Peak Load: Supply meter with demand (Kw) reading. Demand reading to show highest peak demand and date and time peak occurred.
- F. Sampling: 15 or 30 minute demand interval (factory default: 15 minutes).
- G. Integral self-contained back-up system to maintain memory and display during power failures.
- H. 0-2V voltage output current sensors to allow paralleling and/or mounting up to 2000-feet from meter. Split core type sensor configuration to allow installation without powering down.
- I. Standards: UL listed; compliant with ANSI C12.1 and C12.16 specifications with split-core current sensors.
- J. Provide meter with following auxiliary device for interfacing to energy management system: digital to analog converter: 0 to 10Vdc or 4 to 20mA, pulser module: 4.5 to 28Vdc, or ModBus communications.
- K. Include a submeter with voltage, current and wire-configuration (2-, 3- or 4-wire, single or three-phase, grounded and ungrounded) as required on drawings.
- L. Conductors from current sensors and conductors for monitoring line voltage can be run in same conduit.

PART 3 - EXECUTION

3.1 UTILITY METERING INSTALLATION

- A. Meter Bases: Locate to provide acceptable access for meter reading and maintenance. Locate to minimize risk of physical damage.
- B. Metering Equipment: Install current transformers supplied by serving electric utility.
- C. Verify utility requirements prior to bidding and provide associated work required by local utility including but not limited to:
 1. Service underground primary including conduit, pull cord, excavation and backfill.
 2. Underground pull vaults.
 3. Pole risers.
 4. Transformer pads, and vaults.
 5. Secondary service lateral raceways.
 6. Grounding of transformers.
 7. Service metering equipment.

3.2 ENERGY METERING INSTALLATION

A. Submetering Equipment:

1. Cabling between current and voltage sensors and meter display enclosure.
2. One-hour video recorded training period for Owner in use of meter.
3. Blank engraved phenol label with white lettering for each meter, listing load monitored (e.g., "Panel A," "Chiller #3," etc.). Use red label with white lettering where load is on generator backup.
4. Commons multiple meter unit cabinet with blank spaces where multiple meters are mounted as shown on one-line diagram and/or floor plans (e.g., 8 meter cabinet with 3 blank spaces where 5 meters are shown in common location).
5. Cabling between meter display enclosure and auxiliary device for communication to energy management system.
6. ModBus cabling between meters, and from meter to energy management system.

END OF SECTION

SECTION 26 2726
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provision of materials, installation and testing of:
1. Wall Switches
 2. Receptacles
 3. Finish Plates
 4. Wall Dimmers
 5. Surface Covers

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
1. Wall switches
 2. Receptacles
 3. Wall Plates
 4. Dimmers
 5. In-Use Cover

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wall Switches:

1. Decorative AC Rocker Switch Characteristics:
 - a. Cooper
 - b. Hubbell
 - c. Leviton
 - d. Legrand P&S
 - e. Or approved equivalent.

B. Receptacles:

1. Commercial Grade:

- a. 20 Amp:
 - 1) Cooper 5362
 - 2) Hubbell 5362
 - 3) Bryant CBRS20
 - 4) Leviton 5362S
 - 5) Legrand P&S 5362
 - 6) Or approved equivalent.

2. Ground Fault Circuit Interrupter (GFCI) Receptacle - 20 Amp:

- a. Cooper WRSGF20W
- b. Hubbell GFR5362SGW
- c. Legrand P&S 2097TRWR
- d. Or approved equivalent.

C. Finish Plates:

1. Bryant
2. Cooper
3. Hubbell
4. Leviton

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5. Legrand P&S
 6. Or approved equivalent.
- D. Wall Dimmers:
1. Lutron Maestro Series
 2. Or approved equivalent.
- E. Surface Covers:
1. Aluminum with Gasket, Blanks, Single Gang:
 - a. Bell 240-ALF
 - b. Carlon
 - c. Or approved equivalent.
 2. 2-Gang:
 - a. Bell 236-ALF
 - b. Carlon
 - c. Or approved equivalent.
 3. While-in-Use Weatherproof Cover:
 - a. Die Cast Cover:
 - 1) Intermatic
 - 2) Hubbell
 - 3) Cooper
 - 4) Or approved equivalent.
- F. Provide lighting switches and receptacles of common manufacturer and appearance.
- 2.2 WALL SWITCHES
- A. Characteristics: Toggle type, quiet acting, 20 amp, 120/277 volt, UL listed for motor loads up to 80 percent of rated amperage, extra heavy duty.
 - B. Finish: White.
- 2.3 RECEPTACLES
- A. Duplex Receptacles Characteristics: Straight parallel blade, 125 volt, 2 pole, 3 wire grounding.
 1. Commercial Grade: Riveted. Back and side wired. Brass ground contact on steel strap. Nylon face and nylon base. 20 amp.

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- B. Ground Fault Circuit Interrupter (GFCI) Receptacle: Feed through type, back-and-side wired, tamper-resistant, weather resistant self-testing, 20 amp, 125VAC.
- C. Special Purpose Receptacles: Reference Drawings for NEMA Standard Specification.
- D. Finish:
 - 1. Same exposed finish as switches.
 - 2. Receptacles installed in surface raceway to match raceway finish. See Section 26 05 33, Raceways.
 - 3. All automatically controlled, nonlocking type, 125 volt, 15 amp and 20 amp rated receptacles to be permanently marked by the manufacturer with the "universal power" symbol and the word "controlled."

2.4 FINISH PLATES

- A. Finish Plates: Type 302 stainless steel with smooth satin finish.
- B. Provide telephone/signal device plates; activated outlets to have coverplates to match modular jack.

2.5 WALL DIMMERS

- A. Provide wall dimmers compatible with type of load controlled (i.e. line voltage, low voltage, 2-wire, 3-wire, 0-10v). Finish to match wall switches. Size dimmers to accept connected load. Do not cut fins. Where dimmers are ganged together, provide a single multi gang coverplate.
- B. LED indicator dots show by what percentage controlled lighting is dimmed. Programmable settings for maximum and minimum trim settings, and rate of change in lighting levels.

2.6 SURFACE COVERS

- A. Material: Galvanized steel, drawn, 1/2-inch raised industrial type with openings appropriate for devices installed on surface receptacles.
- B. Cast Box and Extension Adaptors: Aluminum with gasket, blanks single gang or 2-gang.
- C. While-in-Use Weatherproof Cover: NEMA 3R when closed over energized plug. Vertical mount for duplex receptacle. Provide continuous use cover with cover capable of closing over energized cord cap with bottom aperture for cord exit.
 - 1. Die cast cover with closed cell neoprene foam gasket: Capable of being locked closed to prevent tampering or unauthorized use.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. See Architectural elevations for location and mounting height of wiring devices. Review Architectural elevations prior to rough-in and contact Architect immediately if conflicts are found between Architectural and Electrical Drawings. Do not rough-in devices until conflicts are resolved.

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- B. Install wiring devices and finish plates plumb with building lines, equipment cabinets and adjacent devices. Devices not plumb will be fixed at no additional cost to Owner.
- C. Orientation:
 - 1. Install wiring devices with long dimension oriented vertically at centerline height shown on drawings or as specified.
 - 2. Vertical Alignment: When more than one device is shown on drawings in close proximity to each other, but at different elevations, align devices on a common vertical center line for best appearance. Verify with Architect.
 - 3. Horizontal Alignment: When more than one device is shown on drawings in close proximity to each other with same elevation, align devices on a common horizontal center line for best appearance. Verify with Architect.
- D. Provide labeling per Section 26 05 53, Identification for Electrical Systems.
- E. Test wiring devices to ensure electrical continuity of grounding connections, and after energizing circuitry, to demonstrate compliance with requirements. Test receptacles for line to neutral, line to ground and neutral to ground faults. Correct any defective wiring.

3.2 WALL SWITCHES INSTALLATION

- A. At time of substantial completion, replace those items which have been damaged.

3.3 RECEPTACLES INSTALLATION

- A. Upon installation, adhere to proper and cautious use of convenience receptacles. At time of substantial completion, replace those items which have been damaged, including those burned and scored by faulty receptacles or cord caps.
- B. In the following outlet locations, regardless of whether shown as GFCI on Drawings, either provide a GFCI duplex receptacle, or use a GFCI breaker where code would require a GFCI outlet to have a remote test switch:
 - 1. Bathrooms.
 - 2. Where receptacles are installed within 6-feet, 0-inches from edge of sinks.
 - 3. Kitchens above counters.
 - 4. On rooftops.
 - 5. Outdoors.
 - 6. Where serving vending machines.
 - 7. Where serving electric drinking fountains.
- C. GFCI Receptacles: One GFCI receptacle may not be used to provide GFCI protection to downstream duplex receptacles on the same branch circuit.

3.4 FINISH PLATES INSTALLATION

- A. Do not install items until finish painting is complete. Replace scratched and paint splattered finish plates and wiring devices.

3.5 WALL DIMMERS INSTALLATION

- A. Install per manufacturer's recommendations and wiring diagrams.

3.6 SURFACE COVERS INSTALLATION

- A. Do not install items until finish painting is complete. Replace scratched and paint splattered finish plates and wiring devices.

END OF SECTION

SECTION 26 2800
OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Fuses
2. Molded Case Circuit Breakers
3. Fuse Cabinets

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Product data and instantaneous let-through current curves and average melting time current curves for fuses supplied to project.
2. Product data and time/current trip curves for circuit breakers supplied to project.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements apply to this Section.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fuses:

1. Bussmann
2. Ferraz-Shawmut

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3. Littelfuse
 4. McGraw-Edison
 5. Or approved equivalent.
- B. Molded Case Circuit Breakers:
1. Eaton Electrical
 2. ABB/General Electric
 3. Siemens
 4. Schneider Electric/Square D
 5. Or approved equivalent.
- C. Fuse Cabinet:
1. Bussmann
 2. Circle AW
 3. Ferraz-Shawmut
 4. Littelfuse
 5. Siemens
 6. Schneider Electric/Square D
 7. Or approved equivalent.

2.2 FUSES

- A. Characteristics:
1. Dual element, time delay, current limiting, nonrenewable type, rejection feature.
 2. Combination Loads: UL Class RK1, RK5, or J, 1/10 to 600 amp. UL Class L, above 600 amps.
 3. Motor Loads: UL Class RK5, 1/10 to 600 amp.
 4. Fuse pullers for complete range of fuses.

2.3 MOLDED CASE CIRCUIT BREAKERS

- A. 1-, 2- or 3-pole bolt-on, single handle common trip, 600VAC or 250VAC as indicated on Drawings.
- B. Overcenter toggle-type mechanism, quick-make, quick-break action. Trip indication is by handle position.
- C. Calibrate for operation in 40 degrees C ambient temperature.

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- D. 15 to 150 Amp Breakers: Permanent trip unit containing individual thermal and magnetic trip elements in each pole.
- E. 151 to 400 Amp Breakers: Adjustable magnetic trip elements. Provide push-to-trip button on cover of breaker for mechanical tripping.
- F. Greater than 401 Amp: Electronic trip type with adjustments for long-time, instantaneous, and short-time functions.
- G. Circuit breakers 1200 Amp and Greater: Provide breaker with energy-reducing maintenance switching with local status indicator per CEC Article 240.87(B).
- H. Provide ground fault function for breakers greater than 800 amps where applied at 480 volts line-to-line; and where indicated on drawings.

2.4 FUSE CABINET

- A. Enclosure:
 - 1. Metallic cabinet surface mounted, with internal shelves, trim cover with hinged and latched door.
 - 2. Size cabinet such that spare fuses required by these Documents do not exceed 50 percent of cabinet volume.
- B. Label: Provide engraved label to identify as spare fuse cabinet.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Coordination:
 - 1. Obtain and review the submitted product data for equipment furnished by the Owner, and furnished under other Divisions of this contract, particularly under Divisions 22 and 23.
 - 2. Confirm the equipment nameplate maximum overcurrent protection (MOCP) and make accommodations and adjustments to overcurrent protective devices as necessary to coordinate with the nameplate rating.
- B. Install all items in accordance with manufacturers written instructions.

3.2 FUSES

- A. Fuses: For each class and ampere rating of fuse installed, provide the following quantities of spares for quantity of fuses installed:
 - 1. 0 to 24: Provide 6 spare.
 - 2. 25 to 48: Provide 9 spare.
 - 3. 49 and Above: Provide 12 spare.

3.3 MOLDED CASE CIRCUIT BREAKERS

- A. Provide testing of ground fault interrupting breakers.
- B. Provide circuit breakers, as specified and on Drawings, for installation in panelboards, individual enclosures or combination motor starters.
- C. Provide ground fault interrupter circuit breakers for equipment in damp or wet locations.
- D. Provide device on handle to lock breaker in "ON" position for breakers feeding time switches, night lights and similar circuits required to be continuously energized.
- E. Shunt Trip Circuit Breakers: Provide wiring to remote trip switch/contacts as indicated on Drawings.
- F. Provide multi-pole branch circuit breakers for multiwire branch circuits for simultaneous disconnection of circuits.

3.4 FUSE CABINETS

- A. Install fuse cabinet on wall in the Electrical Room in coordination with electrical equipment.

END OF SECTION

SECTION 26 2816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Toggle Type Disconnect Switches
2. Manual Motor Starters
3. Safety Switches
4. Enclosed Circuit Breakers
5. Molded Case Switches

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
1. Section 26 05 73, Electrical Distribution System Studies.
 2. Section 26 24 13, Switchboards.
 3. Section 26 24 16, Panelboards.
 4. Section 26 28 00, Overcurrent Protective Devices.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

2.1 MANUFACTURERS

A. Toggle Type Disconnect Switches:

1. Cooper
2. Hubbell
3. Leviton
4. Legrand (Pass & Seymour)
5. Slater
6. Or approved equivalent.

B. Manual Motor Starters:

1. Eaton Electrical
2. ABB/General Electric
3. Siemens
4. Schneider Electric/Square D
5. Or approved equivalent.

C. Safety Switches:

1. Eaton Electrical
2. ABB/General Electric
3. Siemens
4. Schneider Electric/Square D
5. Or approved equivalent.

D. Enclosed Circuit Breakers:

1. Eaton Electrical
2. ABB/General Electric
3. Siemens
4. Schneider Electric/Square D
5. Or approved equivalent.

E. Molded Case Switches:

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1. Eaton Electrical
2. ABB/General Electric
3. Siemens
4. Schneider Electric/Square D
5. Or approved equivalent.

2.2 TOGGLE TYPE DISCONNECT SWITCHES

- A. Rating: 120 or 277 volt, 1 or 2 pole, 20 amp, 1 hp maximum.
- B. Enclosure:
 1. NEMA 1: Dry locations/Indoors.
 2. NEMA 3R: Damp or wet locations/Outdoors.
- C. Handle lockable in 'off' position.

2.3 MANUAL MOTOR STARTERS

- A. Quick-Make, Quick-Break. Thermal overload protection. Device labeled with maximum voltage, current, and horsepower.
- B. Enclosure:
 1. NEMA 1: Dry locations/Indoors.
 2. NEMA 3R: Damp or wet locations/Outdoors.

2.4 SAFETY SWITCHES

- A. Heavy duty fusible type and non-fusible type (as indicated on drawings), dual rated, quick-make, quick-break with fuse rejection feature for use with Class R fuses only, unless other fuse type is specifically noted.
- B. Clearly marked for maximum voltage, current, and horsepower.
- C. Operable handle interlocked to prevent opening front cover with switch in 'on' position.
- D. Switches rated for maximum available fault current.
- E. Handle lockable in 'off' position.
- F. Enclosure:
 1. NEMA 1: Dry locations/Indoors.
 2. NEMA 3R: Damp or wet locations/Outdoors.
- G. Fusible Switch Assemblies: NEMA KS 1, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover

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with switch in ON position. Handle lockable in OFF position. Fuse clips: Provide fuse rejection feature for Class R or J fuses up to 600 amp. Remove if circuit breaker type is used. Provide switches of 30 to 200 amp with plug-on line side connections.

- H. Fusible Switch Assemblies, 800 Amperes and Larger: Bolted pressure contact switches. Fuse Clips: Designed to accommodate Class L fuses. Provide with shunt-trip and ground fault capabilities. Remove if circuit breaker type is used.

2.5 ENCLOSURE CIRCUIT BREAKERS

- A. Molded case circuit breakers:

1. 1-, 2-, or 3-pole bolt on, single-handle common trip, 600VAC or 250VAC as indicated on drawings.
2. Overcenter toggle-type mechanism, quick-make, quick-break action. Trip indication is by handle position.
3. Calibrate for operation in 40C ambient temperature.
4. 15 to 150 Amp Breakers: Permanent trip unit containing individual thermal and magnetic trip elements in each pole.
5. 151 to 400 Amp Breakers: Variable magnetic trip elements. Provide push-to-trip button on cover of breaker for mechanical tripping.
6. Greater than 401 Amp: Electronic trip type with adjustments for long-time, instantaneous, and short-time functions. Provide ground fault function for breakers greater than 400 amps.
7. Provide handle mechanisms that are lockable in the open (off) position.
8. Circuit breakers to have minimum symmetrical interrupting capacity as indicated on Drawings.

- B. Enclosure:

1. NEMA 1: Dry locations/Indoors.
2. NEMA 3R: Damp or wet locations/outdoors.

2.6 MOLDED CASE SWITCHES

- A. Removable cover, galvanized steel enclosure, powder coat painted.
- B. Provide cover padlock provision.
- C. Provide trip unit with no overcurrent, overload, or low level fault protection. Trip unit to be high instantaneous magnetic fixed trip type with magnetic trip reset at factory to interrupt high fault currents at or above preset level.
- D. Enclosure:
1. NEMA 1: Dry locations/Indoors.

2. NEMA 3R: Damp or wet locations/Outdoors.

PART 3 - EXECUTION

3.1 General Installation Requirements

- A. Obtain and review the submitted product data for equipment furnished by the Owner, and furnished under other Divisions of this contract, particularly under Divisions 22 and 23.
- B. Confirm the equipment nameplate maximum overcurrent protection (MOCP) and make accommodations and adjustments to switches, fuses and circuit breakers as necessary to coordinate with the nameplate rating
- C. Install in accordance with manufacturer's instructions.
- D. Provide engraved nameplates per Section 26 05 53, Identification for Electrical Systems.
- E. Provide arc flash labels per Section 26 05 73, Electrical Distribution System Studies.
- F. Apply neatly typed adhesive tag on inside door of each fusible switch indicating NEMA fuse class and size installed.

3.2 Toggle Type Disconnect Switches

- A. Install fuses in fusible disconnect switches. Coordinate fuse ampere rating with installed equipment. Do not provide fuses of lower ampere rating than motor starter thermal units.
- B. Install products, systems and equipment in accordance with manufacturer's written instructions and requirements.
- C. See General Installation Requirements above.

3.3 Manual Motor Starters

- A. Provide disconnecting means within sight of each motor controller and of each motor. Motor controller disconnecting means equipped with lock-out/tag-out padlock provisions do not require a disconnect switch at the controlled motor location. Locate disconnect means in view of and not inside of equipment, such that tools are not needed to remove covers to access the disconnecting means.
- B. Install products, systems and equipment in accordance with manufacturer's written instructions and requirements.
- C. See General Installation Requirements above.

3.4 Safety Switches

- A. Install products, systems and equipment in accordance with manufacturer's written instructions and requirements.
- B. See General Installation Requirements above.

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3.5 Enclosed Circuit Breakers

- A. Install products, systems and equipment in accordance with manufacturer's written instructions and requirements.

- B. See General Installation Requirements above.

3.6 Molded Case Switches

- A. Install products, systems and equipment in accordance with manufacturer's written instructions and requirements.

- B. See General Installation Requirements above.

END OF SECTION

SECTION 26 5100
LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Luminaires
 - 2. LED Drivers
 - 3. Lamps
- B. Provide wiring for complete and operating lighting system.

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. NECA 500 - Commercial Lighting.
 - 2. UL 8750 - Light Emitting Diode (LED) equipment for use in lighting products.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Submit product data for:
 - a. LED Luminaires: Electrical ratings, dimensions, mounting, material, clearances, terminations, wiring, connection diagram, LM-79 photometric data, LM-80 lumen depreciation data.
 - b. LED Drivers
 - c. Lamps
 - 2. Submittal Cutsheets: Highlight, circle or otherwise graphically indicate which option(s) are being selected for the products submitted. Cutsheets that are not edited to indicate which products and options are submitted for this project or that list only catalog numbers to identify submitted options are not acceptable.

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3. Specified manufacturers are approved to submit bid. However, inclusion does not relieve manufacturer from supplying product as described.
4. Provide the following operating and maintenance instructions as required by Section 26 00 00, Electrical Basic Requirements:
 - a. Luminaires
 - b. LED Drivers
 - c. Lamps

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 1. Provide luminaires acceptable to code authority for application and location installed.
 2. Comply with applicable ANSI standards.
 3. Comply with applicable NEMA standards.
 4. Provide luminaires and lampholders that comply with UL standards and have been listed and labeled for location and use indicated by a testing agency acceptable by the AHJ (e.g., UL, ETL, and the like).
 5. Comply with CEC as applicable to installation and construction of luminaires.
 6. Comply with fallout and retention requirements of CBC for diffusers, baffles, and louvers.
 7. Provide LED luminaires from the same manufacturer and manufacturing LED source batch for similar applications (e.g., all LED downlights from a single manufacturer and batch, all linear LED products from single manufacturer and batch).

1.6 WARRANTY

- A. Warranty as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 1. LED Luminaire Manufacturer's Warranty: Not less than 5 years for luminaire based on date of substantial completion. Includes normal cost of labor to replace luminaire. Replacement luminaire will match physical dimensions, physical appearance, chromaticity, lumen output and photometric characteristics of original installed equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Luminaires:

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1. Reference description and manufacturers in Luminaire Schedule on Drawings.
2. Or approved equivalent.

B. LED Drivers:

1. Indoor Drivers:
 - a. eldoLED Series
 - b. Advance/Philips
 - c. Osram Sylvania
 - d. Or approved equivalent.
2. Outdoor Drivers:
 - a. Advance/Philips
 - b. Osram Sylvania
 - c. LG
 - d. Or approved equivalent.

C. Lamps:

1. LED (Light Emitting Diode) Lamps:
 - a. Nichia
 - b. Cree
 - c. Osram Sylvania
 - d. GE Lummation
 - e. Or approved equivalent.
2. Unless specific manufacturer not shown on this list is indicated in the Luminaire Schedule.
3. Special types as indicated in Luminaire Schedule.
4. Or approved equivalent.

2.2 LUMINAIRES

- A. Luminaires: Reference description and manufacturers in Luminaire Schedule on Drawings.
- B. Where recessed luminaires are installed in cavities intended to be insulated, provide IC rated luminaires or other code approved installation.
- C. UL label luminaires installed under canopies, roof or open porches, and similar damp or wet locations, as suitable for damp or wet location.

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- D. Suspended luminaires: Provide minimum 24-inch adjustability in aircraft cable length where used.
- E. Recessed Luminaires: Frame compatible with ceiling material installed at particular luminaire location. Provide proper factory trim and frame for luminaire to fit location and ceiling material. Verify with Architectural Reflected Ceiling Plan prior to submittals.
- F. Finishes:
 - 1. Manufacturer's standard finish (unless otherwise indicated) over corrosion resistant primer.
 - 2. Interior Light Reflecting Finishes: White or specular finish with not less than 85 percent reflectance.
 - 3. Exterior Finishes: As detailed in Luminaire Schedule or on Drawings. Refer cases of uncertain applicability to Architect for resolution prior to release for fabrication.
- G. Light Transmitting Components:
 - 1. Plastic diffusers, molded or extruded of 100 percent virgin acrylic.
 - 2. Prismatic acrylic, extruded, flat diffusers, 0.125-inch overall thickness, unless otherwise noted.
- H. LED Luminaires:
 - 1. UL listing of luminaire includes drivers, transformers, enclosures, rated wire, communications devices and accessories needed for a complete and functional system.
 - 2. LM-79: Testing and measurement of absolute photometry, chromaticity (CCT) and luminaire power. Report provided by DOE certified independent testing laboratory. CCT as specified in Luminaire Schedule.
 - 3. Standards: ANSI C78.377, LM-79 and LM-82 compliant for performance characteristics, photometry, colorimetry, efficacy and thermal characteristics.
 - 4. LM-80 + TM-21: Testing and measurement, and statistical prediction of LED lamp life. Report provided by DOE certified independent testing laboratory.
 - 5. LEDs in one module/luminaire: Supplied from same batch/bin and fall within 3-step MacAdam Ellipse, or as described in Luminaire Schedule, whichever is the more stringent requirement.
 - 6. Provide luminaires with integral LED thermal management system (heat sinking).
 - 7. Luminaires to be equipped with an LED driver that accepts 120V through 277V, 50Hz to 60Hz (universal). Component-to-component wiring within the luminaire will carry no more than 80 percent of rated current and be listed by UL for use at 600VAC at 302 degrees F/150 degrees C or higher. Plug disconnects to be listed by UL for use at 600VAC, 15A or higher.
 - 8. Provide luminaires with individual LED arrays/modules and drivers that are accessible and replaceable from exposed side of the luminaire.

2.3 LED DRIVERS

A. General:

1. Performance: Meet dimming range called out in Luminaire Schedule, free from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experienced in a commercial environment. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.
2. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
3. Minimum efficiency of 85 percent, power factor greater than or equal to 0.90, compliance with reduction of hazardous substances (RoHS). Rated for operating temperature range of area in which driver is installed.
4. Limit inrush current to minimize breaker tripping.
 - a. Base specification: NEMA 410 standard for inrush current for electronic drivers.
 - b. Preferred Specification: Meet or exceed 30 milliamp-squared-seconds at 277VAC for up to 50 watts of load and 75 amps at 240 microseconds at 277VAC for 100 watts of load.
5. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.
6. No visible change in light output with a variation of plus/minus 10 percent line voltage input.
7. Total Harmonic Distortion less than 10 percent and meet ANSI C82.11 maximum allowable THD requirements at full output. THD at no point in the dimming curve allows imbalance current to exceed full output THD.
8. Support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:
 - a. Adjustment of forward LED voltage, supporting 3V through 55V.
 - b. Adjustment of LED current from 150mA to 1.4A at the 100 percent control input point in increments of 1mA.
 - c. Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the system, and deliver up to 20 percent energy savings early in the life cycle.
9. Operate for a (+/- 10 percent) supply voltage of 120V through 277VAC at 60Hz.
10. UL Recognized under the component program and modular for simple field replacement. Drivers that are not UL Recognized or not suited for field replacement will not be considered.

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11. Ability to provide no light output when the analog control signal drops below 0.3 V, or the DALI/DMX digital signal calls for light to be extinguished and consume 0.5 watts or less in this standby. Control dead band between 0.3V and 0.65V included to allow for voltage variation of incoming signal without causing noticeable variation in luminaire to luminaire output.

B. Light Quality:

1. Over the entire range of available drive currents, driver to provide step-free, continuous dimming to black from 100 percent to 0.1 percent and 0 percent relative light output, or 100 percent to 1 percent light output and step to 0 percent where indicated. Driver to respond similarly when raising from 0 percent to 100 percent.
 - a. Driver must be capable of 20 bit dimming resolution for white light LED drivers or 15 bit resolution for RGBW LED drivers.
2. Driver must be capable of configuring a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels.
3. Drivers to track evenly across multiple luminaires at all light levels, and must have an input signal to output light level that allows smooth adjustment over the entire dimming range.
4. Driver and luminaire electronics to deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100 percent to 0.1 percent luminaire will have:
 - a. LED dimming driver to provide continuous step-free, flicker free dimming similar to incandescent source.
 - b. Base specification: Based on IEEE PAR1789, minimum output frequency should be greater than 1250 Hz.
 - c. Preferred specification: Flicker index to be equal to incandescent, less than 1 percent at all frequencies below 1000 Hz.

C. Control Input:

1. Provide control protocol to match lighting control system specified for use with luminaire.
2. 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers:
 - a. Meet IEC 60929 Annex E for General White Lighting LED drivers.
 - b. Connect to devices compatible with 0 to 10V Analog Control Protocol, Class 2, capable of sinking 0.6 ma per driver at a low end of 0.3V. Limit the number of drivers on each 0-10V control output based on voltage drop and control capacity.
 - c. Meet ESTA E1.3 for RGBW LED drivers.

2.4 LAMPS

- A. Provide lamps for luminaires.

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- B. Provide lamp catalogued for specified luminaire type.
- C. Incandescent Lamps: Not allowed unless noted in Luminaire Schedule.
- D. LED (Light Emitting Diode):
 - 1. LED manufacturer will include, but not be limited to, light source, luminaire, power supply and control interface with added components as needed for complete and functioning system.
 - a. Comply with ANSI chromaticity standard for classifications of color temperature. See Luminaire Schedule for specified LED lamp color and color temperature. UL or ETL listed and labeled.
 - b. Luminaire testing per IESNA LM-79 and LM-80 procedures.
 - c. Lamp life for white LEDs: 50,000 plus hours with lamp failure occurring when LED produces 70 percent of initial rated lumens.
 - d. Lamp life for color LEDs: 30,000 plus hours with lamp failure occurring when LED produces 50 percent of its initial rated lumens.
 - e. LED Drivers: Reverse polarity protection, open circuit protection, require no minimum load. Minimum 80 percent efficiency. Class A noise rating.
 - f. Dimming: LED system capable of full and continuous dimming.
 - g. Correlated Color Temperature (CCT): See Luminaire Schedule for selection of color temperature for each luminaire. Ranges given below reflect maximum allowable tolerances for color temperature range for each nominal CCT.
 - 1) Nominal CCT:
 - a) 2700 K (2725 ± 145)
 - b) 3000 K (3045 ± 175)
 - c) 3500 K (3465 ± 245)
 - d) 4000 K (3985 ± 275)
 - h. Color Rendering Index (CRI) to be greater than or equal to 80.
 - 2. Special types as indicated in Luminaire Schedule.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Install per manufacturer's written installation instructions and requirements.
- B. Install luminaires securely, in neat and workmanlike manner.
- C. Install luminaires of types indicated where shown and at indicated heights in accordance with manufacturer's written instructions and with recognized industry practices to ensure that

luminaires comply with requirements and serve intended purposes.

D. Wiring:

1. Recessed luminaires to be installed using flexible metallic conduit or MC Cable as allowed by Section 26 05 19 with luminaire conductors spliced to branch circuit conductors in nearby accessible junction box over ceiling. Junction box fastened to building structural member within 6-feet of luminaire.
2. Luminaires for lift out and removal from ceiling pattern without disconnecting conductors or defacing ceiling materials.
3. Flexible connections where permitted to exposed luminaires; neat and straight, without excess slack, attached to support device.
4. Install junction box, flexible conduit and high temperature insulated conductors for through wiring of recessed luminaires.

E. Relamp luminaires which have failed lamps at substantial completion.

F. Replace LED drivers deemed as excessively noisy by Architect, Engineer, or Owner.

G. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

H. Support luminaires larger than 2- by 4-foot size independent of ceiling framing.

I. Locate recessed ceiling luminaires as indicated on architectural reflected ceiling plan.

J. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

K. Exposed Grid Ceilings:

1. Support surface mounted luminaires in grid ceiling directly from building structure.
2. Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires.
3. Fasten surface mounted luminaires to ceiling grid members using bolts, screws, rivets, or suitable clips.

L. Install recessed luminaires to permit removal from below.

M. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

N. Install clips to secure recessed grid-supported luminaires in place.

O. Install wall mounted luminaires, emergency lighting units, and exit signs at height as indicated on Architectural Drawings.

P. Install accessories furnished with each luminaire.

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- Q. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- R. Bond products and metal accessories to branch circuit equipment grounding conductor.
- S. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.
- T. Where manufactured wiring assemblies are used, ensure that wiring assembly manufacturer sends components to appropriate luminaire manufacturer for respective installation of proper components.
- U. Coordination:
 - 1. Coordination of Conditions: Coordinate ceiling construction, recessing depth and other construction details prior to ordering luminaires for shipment. Refer cases of uncertain applicability to Architect for resolution prior to release of luminaires for shipment. Where luminaires supplied do not match ceiling construction, replace luminaires at no cost to Owner.
 - 2. Electrical drawings are schematic, identifying quantity and type of luminaires used and their approximate location, but are not to be used for dimensional purposes. Reference architectural drawings for exact locations, including mounting heights.
 - 3. Provide lighting indicated on Drawings with luminaire of the type designated and appropriate for location.
 - 4. Provide LED luminaires with driver compatible to lighting control system as shown in drawings and as specified.
 - 5. Where remote drivers are required, ensure adequate accessibility to driver. Upsize conductors between luminaire and driver to accommodate voltage drop.
- V. Field Quality Control:
 - 1. Perform field inspection in accordance with Division 01, General Requirements.
 - 2. Operate each luminaire after installation and connection. Inspect for proper connection and operation.
- W. Cleaning:
 - 1. Clean electrical parts to remove conductive and deleterious materials.
 - 2. Remove dirt and debris from enclosures.
 - 3. Clean paint splatters, dirt, dust, fingerprints, and debris from luminaires.
 - 4. Clean photometric control surfaces as recommended by manufacturer.
 - 5. Clean finishes and touch up damaged finishes per by manufacturer's instructions.
- X. Demonstrate luminaire operation for minimum of two hours.

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3.2 LUMINAIRES

- A. Install per manufacturer's written installation instructions and requirements.
- B. Align, mount and level luminaires uniformly. Use ball hangers for suspended stem mounted luminaires.
- C. Avoid interference with and provide clearance from equipment. Where indicated locations for luminaires conflict with locations for equipment, change locations for luminaire by minimum distance necessary as directed by Architect.
- D. Suspended Luminaires: Mounting heights indicate clearances between bottom of luminaire and finished floors.
- E. Emergency Egress Luminaires: Provide unswitched circuit for battery charging and autotransfer circuiting for exit signs and luminaires with integral batteries. Where test switch cannot be integral to luminaire, mount remote test switch flush-to-ceiling and adjacent to egress luminaire.
- F. Interior Luminaire Supports:
 1. Support Luminaires: Anchor supports to structural slab or to structural members within a partition, or above a suspended ceiling.
 2. Maintain luminaire positions after cleaning and relamping.
 3. Support luminaires without causing ceiling or partition to deflect.
 4. Provide mounting supports for recessed and pendant mounted luminaires as required by CBC.
- G. Adjusting:
 1. Aim and adjust luminaires as indicated.
 2. Focus and adjust floodlights, spotlights and other adjustable luminaires, with Architect, at such time of day or night as required.
 3. Align luminaires that are not straight and parallel/perpendicular to structure.
 4. Position exit sign directional arrows as indicated.

3.3 LED DRIVERS

- A. Install lamps per manufacturer's installation instructions and requirements.
- B. Where driver is remote mounted, size wiring based on type of driver, driver distance from luminaire, and voltage/power level, and manufacturer's installation instructions.
- C. Protect 0-10V input from line voltage mis-connection, and so it will be immune and the output unresponsive to induced AC voltage on the control leads.

END OF SECTION

SECTION 27 0000
COMMUNICATIONS BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Work included in 27 00 00, Communications Basic Requirements applies to Division 27, Communications work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of communications systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.
- C. Definitions:
 - 1. Provide: To furnish and install, complete and ready for intended use.
 - 2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
 - 3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
 - 4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent," substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.
 - 5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.
 - 6. Entrance Facility (EF): Area or location that contains entrance point (demarcation) cable and associated equipment for telecommunication services entering the building.
 - 7. Equipment Room (ER): Area or location that contains backbone cabling associated with interbuilding cable or cable that connects buildings together in a campus environment. ERs may contain Main Cross-Connects, Intermediate Cross-Connects, Horizontal Cross-Connects, and Telecommunication Rooms.
 - 8. Main Cross-Connect (MC): Area or location that contains telecommunications equipment for connecting backbone cable to/from Intermediate Cross-Connects and Horizontal Cross-Connects. Active telecommunications equipment will often be contained in this area to serve as the telecommunications hub or headend. Backbone cable from Local Exchange Carrier's point of demarcation will connect to building backbone cable or active telecommunications equipment at this location.

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9. Main Point of Entry (MPOE): Area or location where service providers terminate and handoff to customer owned premise cabling system.
10. Main Telecommunications Room (MTR): Location that services as the main distribution point for client/Owner telecommunications system. The MTR connects to each TR and the MPOE. MTR should not be accessible by the service providers. In most cases the MTR is a private space.
11. Intermediate Cross-Connect (IC): Area or location that contains telecommunications equipment for connecting backbone cable from the MC to backbone cable distributing to one or many Horizontal Cross-Connects. This location may contain active telecommunications equipment.
12. Horizontal Cross-Connect (HC): Area or location that contains telecommunications equipment, cable terminations and cross-connect wiring. HC is the recognized connection point between backbone and horizontal pathway facilities.
13. Telecommunications Room (TR): Area or location containing telecommunications equipment, cable terminations and cross-connect wiring. Three applications serviced by TRs are horizontal cable connections, backbone system interconnection and entrance facilities. The TR provides facilities (space, power, grounding, etc.) for housing telecommunications equipment. TR may contain a MC, IC or HC and a demarcation point or an interbuilding entrance facility.
14. Interbuilding Cable: Backbone cable associated with connecting buildings together in a multibuilding or campus environment.
15. Intrabuilding Cable: Backbone cable associated with connecting Entrance Facility, Equipment Rooms, Main Cross-Connects, Intermediate Cross-Connects, Horizontal Cross-Connects, and Telecommunication Rooms together on single floor or multifloor building.

1.2 RELATED SECTIONS

- A. Contents of Section applies to Division 27, Communications Contract Documents.
- B. Related Work:
 1. Additional conditions apply to this Division including, but not limited to:
 - a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
 - b. Drawings
 - c. Addenda
 - d. Owner/Architect Agreement
 - e. Owner/Contractor Agreement
 - f. Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

- A. References and Standards per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, individual Division 27, Communications Sections and those listed in this Section.
- B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
 1. State of California:
 - a. CBC - California Building Code
 - b. CEC - California Electrical Code
 - c. CEC T24 - California Energy Code Title 24
 - d. CFC - California Fire Code
 - e. CMC - California Mechanical Code
 - f. CPC - California Plumbing Code
 - g. CSFM - California State Fire Marshal
- C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
 1. ABA - Architectural Barriers Act
 2. ADA - Americans with Disabilities Act
 3. ANSI - American National Standards Institute
 - a. ANSI/TIA-526-7-A Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
 - b. ANSI/TIA-526-14-C Optical Power Loss of Installed Multimode Fiber Cable Plant
 - c. ANSI/TIA-568.0-E - Generic Telecommunications Cabling for Customer Premises
 - d. ANSI/TIA-568.1-E - Commercial Building Telecommunications Infrastructure Standard
 - e. ANSI/TIA-568.2-D Balanced Twisted-Pair Telecommunications Cabling and Components Standard
 - f. ANSI/TIA-568.2-D-2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standard Addendum 2
 - g. ANSI/TIA-568.3-D - Optical Fiber Cabling Components Standard. Commercial Building Telecommunicating Cabling Standard
 - h. ANSI/TIA-568.3-D-1- Optical Fiber Cabling Components Standard.

- i. ANSI/TIA-568.4-D Broadband Coaxial Cabling and Components
- j. ANSI/TIA-569-E - Commercial Building Standard for Telecommunications Pathways and Spaces
- k. ANSI/TIA-570-D - Residential Telecommunications Infrastructure Standard
- l. ANSI/IA-598-D Optical Fiber Cable Color Coding
- m. ANSI/TIA-598-D-1 Optical Fiber Color Coding in Cable Addendum 1, additional Colors for Elements 3-16
- n. ANSI/TIA-598-D-2 Optical Fiber Cable Color Coding Addendum 2, Jacket Color for OM5 Indoor Fiber Cables
- o. ANSI/TIA-606-C - Administration Standard for Commercial Telecommunications Infrastructure
- p. ANSI/TIA-J-STD-607-D - Generic Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
- q. ANSI/TIA-942 - Telecommunications Infrastructure Standard for Data Centers
- 4. APWA - American Public Works Association
- 5. ASCE - American Society of Civil Engineers
- 6. ASHRAE Guideline 0, the Commissioning Process
- 7. ASIS INTL - American Society for Industrial Security International
- 8. ASTM - ASTM International
- 9. AVIXA - Producer of InfoComm and international trade organization representing the audiovisual industry
- 10. BICSI - Building Industry Consulting Service International
 - a. BICSI TDMM - Telecommunications Distribution Methods Manual, 14th Edition
 - b. BICSI ESSDRM - Electronic Safety & Security Design Reference Manual
 - c. BICSI OSPDRM - Outside Plant Design Reference Manual, 6th Edition
- 11. CFR - Code of Federal Regulations
- 12. EPA - Environmental Protection Agency
- 13. ETL - Electrical Testing Laboratories
- 14. FCC - Federal Communications Division
- 15. IBC - International Building Code
- 16. IEC - International Electrotechnical Commission

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17. IEEE - Institute of Electrical and Electronics Engineers
18. ISO - International Organization for Standardization
19. NEC - National Electric Code
20. NEMA - National Electrical Manufacturers Association
21. OSHA - Occupational Safety and Health Administration
22. TIA - Telecommunications Industry Association
23. UL - Underwriters Laboratories Inc.

1.4 SUBMITTALS

- A. See Division 01, General Requirements for Submittal Procedures.
- B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.
- C. In addition:
 1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
 2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. Copy Architect on all transmissions/submissions.
 3. Product Data: Provide manufacturer's descriptive literature for products specified in Division 27, Communications Sections.
 4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and Drawings.
 - a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades. Provide a red rectangle around part number and description with corresponding red arrow pointing to the item/material being

- submitted.
- b. Include technical data, installation instructions, and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 27, Communications specification Sections for specific items required in product data submittal outside of these requirements.
- c. See Division 27, Communications individual Sections for additional submittal requirements outside of these requirements.
5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer's comments. Identify Engineer's comments and provide an individual response to each of the Engineer's comments. Cloud changes in the submittals and further identify changes which are in response to Engineer's comments.
7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-16 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.
8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 27, Communications Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.
9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
10. Substitutions and Variation from Basis of Design:
- a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
- b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals." For any product marked "or approved equivalent," a substitution request must be

submitted to Engineer for approval prior to purchase, delivery or installation.

11. Shop Drawings:

- a. Provide coordinated Shop Drawings which include physical characteristics of all systems, device layout plans, and control wiring diagrams. Reference individual Division 27, Communications specification Sections for additional requirements for Shop Drawings outside of these requirements.
- b. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.

12. Samples: Provide samples when requested by individual Sections.

13. Resubmission Requirements:

- a. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Changes made for the resubmittal will be indicated in a cover letter with reference to page(s) changed and will reference response to comment. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
- b. Resubmit for review until review indicates no exception taken, or "make corrections as noted."
- c. When submitting Drawings for Engineers re-review, clearly indicate changes on Drawings and "cloud" any revisions. Submit a list describing each change.

14. Operation and Maintenance Manuals, Owner's Instructions:

- a. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
 - 1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
 - 2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment: batteries, lamp lenses, speakers and filters.
 - 3) Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00,

Communications Basic Requirements and individual Sections.

- 4) Include product certificates of warranties and guarantees.
 - 5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and subassemblies.
 - 6) Include copy of burn-in and test reports specific to each piece of equipment.
 - 7) Include copy of software/appliance programming.
 - 8) Include commissioning reports.
 - 9) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.
- b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Submit copy of material used for Owner instruction. Field instruction per Section 27 00 00, Communications Basic Requirements Article titled "Demonstration."
 - c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.
15. Record Drawings:
- a. Maintain at site at least one set of drawings for recording "as-constructed" conditions. Indicate on Drawings changes to original documents by referencing revision document, and include buried elements, location of conduit, and location of concealed communication items. Include items changed by field orders, supplemental instructions, and constructed conditions.
 - b. Record Drawings are to include equipment and connection schedules that accurately reflect "as constructed or installed" for project.
 - c. At completion of project, input changes to original project on CAD Drawings and make one set of black-line Drawings created from CAD Files in version/release equal to Contract Drawings. Submit CAD Files and Drawings upon substantial completion.
 - d. Invert elevations and dimensioned locations for incoming utilities and site raceways below grade extending to 5-feet outside building line.
 - e. See Division 27, Communications individual Sections for additional items to include in Record Drawings.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
- B. Whenever this Specification calls for material, workmanship, arrangement, or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.
- C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., conduit) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.
- D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.
- E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
- F. Provide products that are UL listed.
- G. Contractor Qualifications:
 - 1. Minimum of five years' experience in the design, installation, testing and maintenance of communications systems.
 - 2. Must employ at least one full time BICSI certified Registered Communications Distribution Designer (RCDD) who is involved in reviewing work performed by contractor on this project.
 - 3. Maintain a local service facility which stocks spare devices and/or components for servicing systems.
 - 4. Be able to provide project references for three projects, including scope of Work, project type, Owner/user contact name and telephone number.
 - 5. The contractor selected for this project must be certified by the manufacturer of the approved products and utilize these components for completion of work.

1.6 WARRANTY

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements

and individual Division 27, Communications Sections.

- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

- A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, plumbing equipment/fixtures, fire sprinklers, plumbing, lights, cable trays and electrical services with architectural and structural requirements, and other trades (including ceiling suspension and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.
- B. Advise Architect in event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.
- C. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.
- D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to jacks, patch panels, equipment connection cords and wall plates.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL approved or have adequate approval or be acceptable by State, County, and City authorities. Equipment/fixture supplier is responsible for obtaining state, county, and city acceptance on equipment/fixture not UL approved or not listed for installation.
- B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- C. Hazardous Materials:
1. Comply with local, State of California, and Federal regulations relating to hazardous materials.
 2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
 3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous

materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

- A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.
- B. Install equipment requiring access (i.e., amplifiers, taps, zone controllers, volume controls, and storage devices) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing and coordination with other trades and disciplines.
- D. Earthwork:
 1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:
 - a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork divisions. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
 - b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
 - c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.
- E. Firestopping:
 1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:
 - a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

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- F. Plenums: In plenums, provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.

3.2 SEISMIC CONTROL

- A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 27 Communications Sections.
- B. General:
1. Earthquake resistant designs for Communications (Division 27) equipment and distribution, i.e. cabinets and racks, ceiling assemblies, raceways, ladder racking, etc. to conform to regulations of jurisdiction having authority.
 2. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.
 3. Provide stamped Shop Drawings from licensed Structural Engineer of seismic bracing and seismic movement assemblies for cabinets, racks, major equipment and overhead raceways. Engineer to design and provide stamped Shop Drawings cabinets, racks, major equipment and overhead raceway. Submit Shop Drawings along with equipment submittals.
 4. Provide stamped Shop Drawings from licensed Structural Engineer of seismic flexible joints for piping and crossing building expansion or seismic joints. Submit Shop Drawings along with seismic bracing details.
 5. Provide means to prohibit excessive motion of communications equipment during earthquake.

3.3 REVIEW AND OBSERVATION

- A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.
- B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
1. Underground conduit installation prior to backfilling.
 2. Prior to ceiling cover/installation.
 3. When main systems, or portions of, are being tested and ready for inspection by AHJ.
- C. Final Punch: Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CONTINUITY OF SERVICE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:
1. During remodeling or addition to existing structures, or addition of a structure to existing structure, while existing structure is occupied, current services to remain intact until new construction, facilities or equipment is installed.
 2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new wiring to point of connection.
 3. Coordinate transfer time to new service with Owner. If required, perform transfer during off peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.
 4. Organize work to minimize duration of power interruption.

3.5 CUTTING AND PATCHING

- A. Confirm Cutting and Patching Requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:
1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
 2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
 3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
 4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
 5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

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3.6 EQUIPMENT SELECTION AND SERVICEABILITY

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

3.7 DELIVERY, STORAGE AND HANDLING

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:

1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.
2. Protect all equipment and conduit to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.

3.8 DEMONSTRATION

- A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.
- B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.
- C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.9 CLEANING

- A. Confirm Cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.
- B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

- A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.
- B. Install equipment and devices in accordance with manufacturer's installation instructions, plumb and level and firmly secured to mounting surfaces. Maintain manufacturer's recommended clearances.
- C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test operation and demonstrate compliance with requirements. Replace damaged or malfunctioning equipment.
- D. Provide miscellaneous supports/metals required for installation of equipment.

3.11 PAINTING

- A. Confirm Painting requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:
 1. Ferrous Metal: After completion of communications work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces in telecommunications rooms, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
 2. In a telecommunications room, on roof or other exposed areas, equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect. Fire rated plywood backboards to receive two coats of fire retardant paint on all six sides; color to be white.
 3. See individual equipment Specifications for other painting.
 4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
 5. Conduit: Clean, primer coat and paint interior conduit exposed in finished areas with two coats paint suitable for metallic surfaces. Color selected by Architect.
 6. Covers: Covers such as handholes, maintenance holes, vaults, pullboxes and the like will be furnished with finishes which resist corrosion and rust. Covers shall be identified with 'Communications'. It is the contractor's responsibility to proactively seek and obtain approval with Owner prior to purchasing and prior to installation for terms of satisfaction.

3.12 ACCEPTANCE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:
 1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and

manufacturer's installation instructions, particularly in reference to following:

- a. Testing Reports, as outlined in their respective Division sections
- b. Cleaning
- c. Operation and Maintenance Manuals
- d. Training of Operating Personnel
- e. Record Drawings, including cabling identifications, symbols, and locations
- f. Warranty and Guaranty Certificates, including extended manufacturer's warranties
- g. Start-up/test Documents and Commissioning Reports

3.13 FIELD QUALITY CONTROL

- A. Confirm Field Quality Control requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.
- B. Tests:
 1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in Operation and Maintenance Manuals. All cabling test results shall be included.
 2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.14 LETTER OF CONFORMANCE

- A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that Communications items were installed in accordance with manufacturer's recommendations, and UL listings and approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

END OF SECTION

SECTION 27 0528
PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Electrical Metallic Tubing and Fittings
 - 2. Conduit Accessories
 - 3. Penetration Sealing Systems
 - 4. Telecommunications Outlet Boxes
 - 5. Pull Boxes
 - 6. J-Hooks
- B. This Section specifies the requirements to provide communications conduit raceways, boxes, cable trays, innerduct and fittings.

1.2 RELATED SECTIONS

- A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. Provide plan drawings showing completions and as-built corrections which indicate type, size, placement, routing and/or length for raceway and cable tray components; e.g., manholes, handholes, conduit, boxes, enclosures, etc.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.7 DEFINITIONS

- A. Cabinet: A freestanding floor-mounted modular enclosure designed to house and protect rack-mounted electronic equipment.
- B. Conduit: Round raceway.
- C. Conduit Body: Separate portion of a conduit or tubing system that provides access through removable cover(s) to the interior of the system at a junction of two or more sections of the system or at a terminal point of the system.
- D. Pull Box Enclosure: Box with a cover installed in one or more runs of raceway to facilitate pulling conductors through the raceway system. There are no openings in the cover.
- E. Raceway: Enclosed channel designed expressly for holding wires or cables. Metal or insulating material and the term includes conduit, tubing, wireways, underfloor raceways and surface raceways; does not include cable tray.
- F. Surface Raceway: Surface-mounted metal channel or plastic duct with snap-in removable covers for housing and protecting electrical wires and cables. Raceway and fittings are designed so sections can be electrically and mechanically coupled together without subjecting cables to abrasion.
- G. Wire Basket Runway Systems: Includes, but are not limited to straight sections of type wire basket runway cable trays, bends, tees, elbows, drop-outs, supports and accessories.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Electrical Metallic Tubing and Fittings:

1. Allied Tube and Conduit
2. Wheatland Tube
3. Appleton
4. Or approved equivalent.

- B. Conduit Accessories:

1. Duct Spacers:
 - a. Carlon
 - b. Allied Tube and Conduit
 - c. Or approved equivalent.
2. Expansion/Deflection Fittings:
 - a. Appleton
 - b. Emerson

- c. Or approved equivalent.
 - 3. Pulltape:
 - a. George-Ingraham
 - b. Greenlee
 - c. Or approved equivalent.
 - 4. Duct Plugs:
 - a. Carlon
 - b. Vikromatic
 - c. Or approved equivalent.
 - C. Penetration Sealing Systems:
 - 1. SEMCO
 - 2. Or approved equivalent.
 - D. Telecommunications Outlet Boxes:
 - 1. Raco
 - 2. Or approved equivalent.
 - E. Pull Boxes:
 - 1. Hoffman
 - 2. Oldcastle (concrete)
 - 3. Or approved equivalent.
 - F. J-Hooks:
 - 1. Erico
 - 2. Or approved equivalent.
- 2.2 ELECTRICAL METALLIC TUBING AND FITTINGS
- A. Type EMT: Electrogalvanized steel tubing.
 - B. Fittings and Conduit Bodies:
 - 1. In-line straight-through steel or malleable iron fittings and Type C conduit bodies only; do not use bends or tees, e.g. Lbs.
 - 2. Wet Areas: Steel compression-type couplings and nipples.
 - 3. Dry Areas: Set screw-type couplings and nipples.

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4. Bonding Locknuts:

- a. Malleable iron with set screws and lug screws.
- b. Insulated Bushing: Malleable iron with integral insulated throat, rated for 150C.
- c. Bonding and Grounding Bushing: Malleable iron with integral insulated throat, rated for 150C, with solderless lugs or lug screws.

2.3 CONDUIT ACCESSORIES

A. Duct Spacers:

1. Nonmetallic base and intermediate duct spacers with locking keyways designed specifically for use with nonmetallic conduit; e.g., Carlon SNAP-LOC duct spacers for 4-inch diameter conduit with 1-1/2-inch separation.

2. Base Spacer: S288NHN.

3. Intermediate Spacer: S289NHN.

B. Expansion/Deflection Fittings: Similar to Crouse-Hinds XD expansion/deflection coupling or Appleton DF Series deflection and expansion coupling.

C. Pulltape: Measuring and pulling tape constructed of synthetic fiber with plastic jacket, printed with accurate sequential footage marks; e.g., George-Ingraham 1/2-inch tape 9216-JK.

D. Duct Plugs:

1. Aboveground Conduit Openings: Tapered PVC plugs with tab for pulltape; e.g., Carlon 4-inch PVC plugs with pull tab, P258NT.

2. Underground or Underslab Conduit Openings: Removable screwtight compression type duct plugs with wing-nut and corrosion resistant hardware; e.g. Vikromatic 4-inch, Part Number 40D402U. Use appropriate part number according to duct size.

2.4 PENETRATION SEALING SYSTEMS

A. Firestopping: Provide fire barrier penetration sealing materials as specified in Division 07, Firestopping Section.

B. Duct Water Seal: Products suitable for closing underground and entrance duct openings, where innerduct or cable is installed, to prevent entry of gases, liquids, or rodents into the structure; e.g., SEMCO PR 851.

2.5 TELECOMMUNICATIONS OUTLET BOXES

A. Five Square Outlet Boxes: Minimum 5-inch square by 2-7/8-inch deep with built-in cable management for use with single- or double-gang plaster rings. Randi P/N T-55017 approved.

2.6 PULL BOXES

A. Construction: NEMA Standard No. 250. Type 1 galvanized steel enclosures designed for use as junction boxes and pull boxes with flat screw-applied covers, with or without knockouts and gray

enamel finish.

2.7 J-Hooks

- A. Constructed of galvanized steel, stainless steel or hot dipped zinc.
- B. Wires or all-thread supports mounted to structure.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Workmanship:
 - 1. Provide, condition, apply, install, connect and test manufactured products, materials, equipment and components in accordance with the manufacturer's specifications and printed instructions.
 - 2. The installation of system components to be carried out under the direction of qualified personnel. Appearance to be considered as important as mechanical and electrical efficiency. Workmanship to meet or exceed industry standards.
 - 3. Place support for raceways, cable trays, backboards, equipment racks and cabinets.
- B. Protection During Construction: Protect products from the effects of moisture, corrosion and physical damage during construction. Except during installation activity in a section, keep openings in conduit, tubing and wireway capped with manufactured seals during construction.
- C. Concrete Sleeves: Conduits routed perpendicular through floors, walls, or other concrete structures to pass through cast-in-place conduit sleeve openings wherever possible, or appropriate size holes to be bored to accommodate the installation of conduit sleeves. The size and location of the holes to not impair the structure's integrity.
 - 1. Concrete Boring: Bore a hole in the concrete with a diameter of 1/2 to 1-inch larger than the conduit sleeve to be installed. Grout around the conduit sleeve and finish to match existing surroundings.
 - 2. Conduits that rise vertically through a slab to be stubbed 6-inches above the floor and capped pending future use.
- D. Drywall/Gypsum Board Sleeves: Install insulating throat bushings on both ends of conduit sleeves placed in fire-rated walls using drywall construction.
- E. Where conduit enters a structure through a concrete roof or membrane waterproofed wall or floor:
 - 1. Provide a watertight seal.
 - 2. With Concrete Encasement: Install watertight entrance seal device on the accessible side.
 - 3. Securely anchor malleable iron body of watertight entrance seal device into construction with one or more integral flanges.

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4. Secure membrane waterproofing to watertight entrance seal device in a permanent, watertight manner.
- F. Provide continuous sleeving through walls, floors and ceilings separating each telecom outlet from its respective MER/TR room, using sleeve conduit size as required per Standards. Restore penetrations through rated assemblies to original fire rating per NFPA and local codes.
- G. Locate sleeves as shown on Drawings. Where sleeves are not shown on Drawings, install sleeves above suspended ceilings and locate to minimize length of pathway for future cable from telecom outlet to MER/TR rooms.
- H. Where sleeves are routed between rooms with floating ceilings, extend conduits horizontally 2-feet over edge of floating ceiling to avoid exposed cabling from being seen at floor level.
- I. Make floor penetrations no more than 4-inches from wall. Install conduit stubs to extend 4-inches from floor base. Cap conduits for protection.
- J. Provide removable heat-expanding pillows at fire barrier penetrations as specified in Firestopping section and described as Firestop Material Type 7 (indicated as FSM-7).
- K. Grounding: Provide ground connections and bonding continuity between raceway and wire basket runway sections, boxes, enclosures, cabinets and fittings as required per code and industry standard.
- L. Provide plenum rated products, components and accessories for installation in plenums.

3.2 ELECTRICAL METALLIC TUBING AND FITTINGS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. Minimum Conduit Size: Size recessed conduits to surface raceway serving multiple data outlets as follows. Sizing is based on TIA/EIA 569-B for 28 percent conduit fill, assuming Category 5e cables (nominal outer diameter 0.24-inch) to each data outlet. Provide recessed backbox between surface raceway and recessed conduit sized for conduit.

1 to 6 cables	1-inch conduit
7 to 10 cables	1-1/4-inch conduit
11 to 15 cables	1-1/2-inch conduit
16 to 20 cables	2-inch conduit
Above 20 cables	Use multiple runs of conduit from surface raceway based on above table

- D. Minimum Backbone Conduit Requirements: Install three 4-inch conduits from MER to each TR, unless otherwise noted on Drawings.
- E. Conduit Type:
 1. Install the following types of circular communications raceway in the locations listed unless otherwise indicated on the Drawings.

- a. Interior Dry Locations, Exposed: EMT with set screw fittings.
- b. Interior Dry Locations, Concealed (Not Embedded in Concrete): EMT with set screw fittings.
- c. Interior Wet Locations: EMT with compression fittings.

F. Conduit Bends and Sweeps:

- 1. Make changes in direction of communications conduit runs with sweeps of the longest possible radius.
- 2. Make sweeps in parallel or banked runs of conduits, 2-inches and larger in diameter, from the same center or centerline so that sweeps are parallel and of neat appearance.
- 3. Field-Made Bends and Sweeps:
 - a. Use an acceptable hickey or conduit-bending machine.
 - b. Do not heat metal raceways to facilitate bending.
 - c. Before installing 4-inch field-made sweeps in duct banks, pull a 3-1/2-inch diameter by 12-inch long mandrel through duct sections to verify circularity and sweep radius.
- 4. The angular sum of the bends between pull points and/or pull boxes to not exceed 180 degrees.
- 5. Minimum Inside Bend Radius for Communications Conduit Bends, Sweeps, Boxes and Fittings:
 - a. One-inch conduit, 11-inches
 - b. Two-inch conduit, 21-inches
 - c. Three-inch conduit, 36-inches
 - d. Four-inch conduit, 48-inches
 - e. Other sizes, 10 times the inside diameter of the conduit.
- 6. Do not install boxes, bends, elbows, tees, conduit bodies and other conduit fittings, which do not provide for the minimum inside cable bend radius specified in paragraph E above.
 - a. Conduit Bodies: In-line straight-through Type C conduit fittings can be used as pull boxes for conduit up to a maximum of 2-inches ID. Other conduit fittings, which include direction changes such as E, L, LB, LR, LL, LRT, TA, TB and X, are not allowed.
 - b. Refer design or installation conflicts with these requirements to the Architect.

3.3 CONDUIT ACCESSORIES

- A. Reference 3.01, General Installation Requirements.

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- B. Install per manufacturer's written instructions and recommendations.
- C. Duct Spacers: Install per manufacturer's recommendation.
- D. Expansion/Deflection Fittings: Install per manufacturer's recommendation.
- E. Pulltape: Install per manufacturer's recommendation.
- F. Duct Plugs: Install per manufacturer's recommendation.

3.4 PENETRATION SEALING SYSTEMS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. Seal conduit entering structures at the first box or outlet to prevent the entrance of gases, liquids, or rodents into the structure.
 - 1. Empty Conduits: Removable screwtight duct plugs.
 - 2. Innerduct Installed: Suitable duct water seal between conduit and innerduct. Manufactured seals in empty innerduct.
 - 3. Cable Installed: Suitable duct water seal between conduit and cable, or between innerduct and cable.

3.5 TELECOMMUNICATIONS OUTLET BOXES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. Provide 4-inch by 4-inch by 2-1/8-inch deep outlet boxes for mounting telecommunications outlets with single-gang or double-gang plaster rings as required, or as indicated on the Drawings.
- D. Do not install outlet boxes back to back in walls. Provide minimum 6-inch separation, except provide minimum 24-inch separation in acoustic-rated walls.
- E. Locate outlet boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for outlet boxes. Use boxes with sufficient depth to permit conduit hubs to be located in masonry void spaces.
- F. Provide knockout closures for unused openings.
- G. Support telecommunications outlet boxes independently of conduit.
- H. Use multiple-gang boxes where more than one device is mounted together; do not use sectional outlet boxes.
- I. Install outlet boxes in walls without damaging wall insulation.
- J. Coordinate mounting heights and locations of outlet boxes mounted above counters, benches and backsplashes.

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- K. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlet boxes in hollow stud wall.

- L. Provide cast outlet boxes in exterior and wet locations.

3.6 PULL BOXES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. In-Ground: Size and install per manufacturer's recommendations.
- D. Aboveground: Size and install per manufacturer's recommendations.

3.7 J-Hooks

- A. Install J-hooks rated for Category 6 cable for support of cabling from the wire basket tray to the outlet location.
- B. J-hooks are to be installed on dedicated wires or all thread rods mounted to structure. J-hooks are not to attach to ceiling grid wires.

END OF SECTION

SECTION 27 0528.28
FIRESTOPPING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Firestop Sealants
 - 2. Firestop Putty

1.2 RELATED SECTIONS

- A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
 - 1. Division 07, Thermal and Moisture Protection.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 27 00 00, Communications Basic Requirements, Communications Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Product Data: Provide manufacturer's standard catalog data for specified products demonstrating compliance with referenced standards and listing numbers of systems in which each product is to be used.
 - 2. Schedule of UL System Drawings: Submit schedule of expected opening locations and sizes, penetrating items and required listed design numbers to seal openings to maintain fire resistance ratings. If engineering recommendations are necessary, list these in the schedule too.
 - 3. UL System Drawings: Furnish copies of UL Systems identified in schedule above. Include any engineering recommendations.
 - 4. Certificates: Product Certificate of Compliance from the firestop system manufacturer certifying material compliance with applicable code and specified performance characteristics.
 - 5. Installation Instructions: Submit manufacturer's printed installation instructions.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Products/Systems: Provide firestopping systems that comply with the following requirements:
 - a. Firestopping tests are performed by a qualified, testing and inspection agency. A qualified testing and inspection agency is UL, or another agency performing testing and follow-up inspection services for firestop system acceptable to authorities having jurisdiction.
 - b. Firestopping products bear the classification marking of qualified testing and inspection agency.
 - 2. Installer Qualifications: Experience in performing work of this Section who is qualified by the firestopping manufacturer as having been provided the necessary training to install firestop products in accordance with specified requirements.
 - 3. General: Use only firestopping products that have been tested for specific fire resistance rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements and fire rating involved for each separate instance.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.7 PERFORMANCE REQUIREMENTS

- A. Fire rated cable pathway devices to be used for ALL low-voltage, video, data and voice cabling, optical fiber raceways and certain high voltage cabling where frequent cable moves, adds and changes may occur. Pathways required for high voltage cabling will be detailed on the Drawings. Such devices will:
 - 1. Meet the hourly fire rating of fire rated wall and or floor penetrated.
 - 2. Be tested for the surrounding construction and cable types involved.
 - 3. Have UL Systems permitting cable loads from "Zero to 100 percent Visual Fill." This requirement eliminates need for fill-ratio calculations to be made by cable technicians to ensure cable load is within maximum allowed by UL System.
 - 4. Not have inner fabric liner that tightens around and compresses cables tightly together encouraging alien cross-talk interference.
 - 5. Be "Zero-Maintenance" defined as: No action required by cabling technician to open and/or close pathway for cable moves, adds, or changes, such as:
 - a. Opening or closing of doors.

- b. Spinning rings to open or close fabric liner.
- c. Removal and/or replacement of any material such as firestop caulk, putty, pillows, bag foam muffins, foam blocks, or foam closures of any sort.
- d. Furnish letter from manufacturer certifying compliance with this definition of Zero-Maintenance.
 - 1) Pathways will be engineered such that two or more devices may be ganged together for larger cable capacities.
 - 2) Pathways will be engineered to be re-enterable so they can be retrofitted and removed from around existing cables without cutting and resplicing them.
 - 3) Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.
- e. Where nonmechanical pathways must be utilized, such as sealing (caulking) around single or grouped conduits, provide products that upon curing do not re-emulsify, dissolve, leach, breakdown, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water, or other forms of moisture characteristic during or after construction. Provide letter from manufacturer certifying compliance with this Section.
- f. Cable pathway to replace conduit sleeves in walls and floors and;
 - 1) When installed individually in floors, devices to pass through core-drilled opening utilizing tested floor plates.
 - 2) When multiple units are ganged in floors, devices to be anchored by means of a tested grid.
 - 3) When installed individually in walls, devices to pass through core-drilled opening utilizing tested wall plates.
 - 4) When multiple units are ganged in walls, devices to be anchored by means of a tested grid.
- g. Cable tray will terminate at each fire barrier and resume on the other side such that cables pass independently through devices. Cable tray will be properly supported on each side of fire barrier.

1.8 PROJECT CONDITIONS

- A. Do not install firestopping products when ambient or substrate temperatures are outside limitations recommended by manufacturer.
- B. Do not install firestopping products when substrates are wet due to rain, frost, condensation, or other causes.

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- C. Maintain minimum temperature before, during and for a minimum 3 days after installation of materials.
- D. Do not use materials that contain flammable solvents.
- E. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- F. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- G. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Firestop Sealants:
 - 1. Basis of Design: Specified Technologies Inc. (STI).
 - 2. Or approved equivalent.
- B. Firestop Putty:
 - 1. Basis of Design: Specified Technologies Inc. (STI).
 - 2. Or approved equivalent.

2.2 FIRESTOP SEALANTS

- A. STI SpecSeal® Brand single component latex formulations that upon cure do not re-emulsify during exposure to moisture, the following products are acceptable:
 - 1. Specified Technologies Inc. (STI) SpecSeal® Series SSS Sealant.
 - 2. Specified Technologies Inc. (STI) SpecSeal® Series LCI Sealant.
- B. Single Source: Obtain firestop systems for each type of penetration and construction condition indicated only from a single manufacturer.
- C. Basis of Design: Firestop components shown on Drawings and listed in this specification Section are designed based on Specified Technologies, Inc. product line. Manufacturer listed is allowed on condition of meeting the specified conditions including the available space for the equipment (including code-required working clearances). Remove and replace components installed not meeting these conditions at no cost to Owner.

2.3 FIRESTOP PUTTY

- A. STI SpecSeal® Brand intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds, the following products are acceptable:
 - 1. Specified Technologies Inc. (STI) SpecSeal® Series SSP Putty.

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- B. Single Source: Obtain firestop systems for each type of penetration and construction condition indicated only from a single manufacturer.
- C. Basis of Design: Firestop components shown on Drawings and listed in this specification Section are designed based on Specified Technologies, Inc. product line. Manufacturer listed is allowed on condition of meeting the specified conditions including the available space for the equipment (including code-required working clearances). Remove and replace components installed not meeting these conditions at no cost to Owner.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Examination:
 - 1. Before beginning installation, verify that substrate conditions previously installed under other Sections are acceptable for installation of firestopping in accordance with manufacturer's installation instructions and technical information.
 - 2. Surfaces will be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellants and any other substances that may inhibit optimum adhesion.
 - 3. Provide masking and temporary covering to protect adjacent surfaces.
 - 4. Do not proceed until unsatisfactory conditions have been corrected.
- B. Install through-penetration firestop systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.
- C. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of firestopping products.
- D. Field Quality Control:
 - 1. Inspections: Owner will engage qualified independent inspection agency to inspect through-penetration firestop systems.
 - 2. Keep areas of work accessible until inspection by authorities having jurisdiction.
 - 3. Where deficiencies are found, repair firestopping products so they comply with requirements.
- E. Adjusting and Cleaning:
 - 1. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
 - 2. Clean surfaces adjacent to sealed openings to be free of excess firestopping materials and soiling as work progresses.
- F. Schedules:

Penetrant Type	Concrete Floor	Concrete Wall	Gypsum Board Wall
Blank Opening	C-AJ-0100, C-	C-AJ-0100, C-	

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	AJ-0101	AJ-0101	
Metal Conduits	C-AJ-1080, C-AJ-1240, C-AJ-1353	C-AJ-1080, W-J-1098, W-J-1100	W-L-1049, W-L-1222, W-L-1168
Plastic Conduits/Raceways	C-AJ-2140, C-AJ-2292	W-J-2018, W-J-2076	W-L-2093, W-L-2241
Cables	C-AJ-3214, C-AJ-3231, F-A-3015	C-AJ-3214, C-AJ-3231, W-J-3098, W-J-3099	W-L-3218, W-L-3219
Cable Trays	C-AJ-4029	W-J-4021, W-J-4022, W-J-4033	W-L-4008, W-L-4029, W-L-4043

G. Documentation:

1. Place system stickers on each side of wall penetrations.
2. Place a reproduction (photocopy) of the UL System description in a document protector and mount to the wall next to the wall penetration. Highlight the Section of the system description that list the allowed cable types.

3.2 FIRESTOP SEALANTS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.3 FIRESTOP PUTTY

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

END OF SECTION

SECTION 27 1500
COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Station Cabling
 - 2. Modular Jacks
 - 3. Work Area Outlets
 - 4. Patch Panels
 - 5. Patch Cords

1.2 RELATED SECTIONS

- A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.
- B. Use this Section in conjunction with other Division 27, Communications specifications and related Contract Documents to establish the total general requirements for the project communications systems and equipment.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. Meet requirements of NFPA 780, Standard for the Installation of Lightning Protection Systems.

1.4 SUBMITTALS

- A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Procedures for cable labeling and identification, long term documentation methods and numbering scheme in accordance with ANSI/TIA/EIA-606A.
 - 2. A copy of certified installer certificates and warranty certificates for products proposed.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. Manufacturers to have a recognized certified installer program in place for system components proposed. Cable will be approved with manufacturer system installed.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Labor, materials and documentation according to selected manufacturer requirements necessary to ensure that the Owner will be furnished with an Extended Product Warranty and Application Assurance of a minimum of 20 years in length. The Application Assurance Warranty will cover the failure of the wiring system to support current or future applications that are designed for the link/channel specifications of ANSI/TIA/EIA-568-C.1. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE-T, 10GBASE-T and 155 Mb/s ATM.
 - 2. A warranty on the physical installation.
 - 3. Necessary documentation required by the manufacturer immediately following 100 percent testing of cables.
- C. Administer the warranty process with the responsible manufacturer's representative. Provide warranty directly to the Owner from the manufacturer. Ensure that the manufacturer provides the Owner with the appropriate warranty certification within 90 calendar days of the final project completion.

1.7 SYSTEM DESCRIPTION

- A. Provide a standards-based cable system to serve horizontal communication systems requirements as specified and as shown on Drawings. Closely follow ANSI/TIA/EIA, IEEE and ISO standards.
- B. The horizontal distribution subsystem refers to intrabuilding twisted-pair communications cabling connecting telecommunications rooms (TRs) to telecommunications outlets (TOs) located at individual work areas and consists of the following:
 - 1. Category 6A 100 ohm, 4-pair, unshielded twisted pair cables from the telecom rooms to the outlets.
 - 2. The horizontal system includes cables, jacks, patch panels and patch cords, as well as the necessary support systems, such as cable managers and faceplates.
 - 3. Cables are routed through conduit, spaces below raised floors, open ceiling areas, non-ventilated spaces above ceiling tile and through plenum air-handling spaces above ceiling tile.
 - 4. Furnish and install materials necessary for a complete and working system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Station Cabling:
 - 1. Belden

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2. CommScope
3. Corning - fiber optic only
4. Leviton/Berk-Tek
5. Ortronics/Superior Essex
6. Panduit
7. Siemon
8. Or approved equivalent.

B. Modular Jacks:

1. Belden
2. CommScope
3. Corning - fiber optic only
4. Leviton/Berk-Tek
5. Ortronics/Superior Essex
6. Panduit
7. Siemon
8. Or approved equivalent.

C. Work Area Outlets:

1. Belden
2. CommScope
3. Corning - fiber optic only
4. Leviton/Berk-Tek
5. Ortronics/Superior Essex
6. Panduit
7. Siemon
8. Or approved equivalent.

D. Patch Panels:

1. Belden
2. CommScope

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3. Corning - fiber optic only
4. Leviton/Berk-Tek
5. Ortronics/Superior Essex
6. Panduit
7. Siemon
8. Or approved equivalent.

E. Patch Cords:

1. Belden
2. CommScope
3. Corning - fiber optic only
4. Leviton/Berk-Tek
5. Ortronics/Superior Essex
6. Panduit
7. Siemon
8. Or approved equivalent.

2.2 STATION CABLING

A. Category 6A Unshielded Twisted Pair:

1. 100 ohm, Category 6A, 23 AWG, 4-pair unshielded twisted pair, CMP rated jacket, color blue.

2.3 MODULAR JACKS

A. Category 6A Modular Jacks:

1. Eight-position modular jack, Category 6A, IDC terminals, T568A/B wiring scheme
2. Each jack must be stamped or have icons to identify it as CAT 6A.
3. Coordinate color with building finishes.

2.4 WORK AREA OUTLETS

A. Flush Mounted Faceplate:

1. One, Two, Three, or Four-port faceplate, constructed from high impact thermo-plastic, with recessed label fields; mounts within a single-gang wall box as indicated on the drawings.

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2. Coordinate faceplate color with building finishes. Submit to Architect for approval prior to installation.
- B. Surface Mounted Outlet Boxes:
 1. Two, Four, or Six-port surface mount box, constructed from high impact thermo-plastic, with recessed label fields.
 2. Coordinate surface box colors with building finishes. Submit to Architect for approval prior to installation.
- C. Dust Covers: Single port dust cover for modular openings, color to match faceplate.

2.5 PATCH PANELS

- A. Category 6A Modular Patch Panels:
 1. 24 port, eight-position modular jack panel, high density, 6 port modules, Category 6A, IDC terminals, T568A/B wiring scheme.
 2. 48 port, eight-position modular jack panel, high density, 6 port modules, Category 6A, IDC terminals, T568A/B wiring scheme.
 3. 24 port, Angled, eight-position modular jack panel, high density, 6 port modules, Category 6A, IDC terminals, T568A/B wiring scheme.
 4. 48 port, Angled, eight-position modular jack panel, high density, 6 port modules, Category 6A, IDC terminals, T568A/B wiring scheme.

2.6 PATCH CORDS

- A. Category 6A Modular Patch Cords: Factory terminated double ended, eight-position to eight-position, modular, stranded conductors, 4 pair, color, blue. 3-feet, 5-feet, and 7-feet.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Miscellaneous Hardware: Provide supporting hardware, cable ties, labels, pull rope and other miscellaneous hardware for a complete and operable system.
- B. Provide like items from one manufacturer, such as jacks, patch panels, equipment connection cords and wall plates.
- C. Horizontal cabling includes cables, jacks, patch panels, connecting blocks and patch cords, as well as the necessary support systems, such as cable managers and faceplates.
- D. Furnish and install materials necessary for a complete and working system.
- E. Contractor must be a Certified Installer for selected manufacturer prior to, during and through completion of the system installation and must be able to provide the manufacturer's extended warranty.
- F. Perform work in a neat and workmanlike manner.

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- G. Install cable after interior of building has been physically protected from the weather and mechanical work likely to damage cabling has been completed.
- H. Before installing cabling, ensure cable pathways are completely and thoroughly cleaned.
 - 1. Inspect conduit, wireway, cable trays and innerduct systems prior to installation.
 - 2. Swab any additional enclosed raceway and innerduct systems.
- I. Provide protection for exposed cables where subject to damage. Provide abrasion protection for any cable or wire bundles, which pass through holes or across edges of sheet metal.
- J. Install cable ties and other cable management clamps via hand so it fits snugly. Do not over tighten or use mechanical tools which could compress, crimp, or otherwise change the physical characteristics of the cable jacket or distort the placement of twisted-pair components. Replace any cable exhibiting stresses due to over tightening of cable management devices.
- K. Where possible, route cables in overhead cable trays and inside wire management systems attached to the equipment cabinets and racks. Use Velcro ties or ducts to restrain cabling installed outside of wire management systems on racks or in cabinets.
- L. Co-install a pull cord (nylon; 1/8-inch minimum) with cable installed in conduit.
- M. Limit cable raceway fill to less than the TIA/EIA-569-B maximum fill for the particular raceway type.
- N. If a J-hook or trapeze system is used to support cable bundles, support horizontal cables at a maximum of 48- to 60-inch intervals. Cables are prohibited to rest on acoustic ceiling grids or panels.
- O. Bundle horizontal distribution cables in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.
- P. Install cable above fire-sprinkler systems and ensure that the cable does not attach to the system or any ancillary equipment or hardware. Install cable system and support hardware such that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
- Q. Do not attach cables to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, install appropriate carriers to support the cabling.
- R. Any cable damaged or exceeding recommended installation parameters during installation will be replaced by the contractor prior to final acceptance at no cost to the Owner.
- S. Determine requirements for plenum rated cable and devices. When in doubt, seek determination in writing by Authority Having Jurisdiction (AHJ) prior to ordering. Without written confirmation from the AHJ, Contractor to assume that a plenum rating is required.
- T. Unshielded Twisted Pair Cable Installation Practices:
 - 1. Install cable in accordance with manufacturer's recommendations and best industry practices.
 - 2. Install cables in continuous lengths from origin to destination (no splices).

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3. Do not exceed the cable's minimum bend radius and maximum pulling tension.
 4. Install unshielded twisted pair cable so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
 5. Do not exceed 25-lbf pulling tension on 4-pair UTP cable.
- U. Provide the following minimum separation distances between pathways for copper communications cables and power wiring of 480 volts or less:
1. Open or Nonmetal Communications Pathways:
 - a. 12-inches from electric motors, fluorescent light fixtures and unshielded power lines carrying up to 3 kVA.
 - b. 36-inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
 - c. 48-inches from large electrical motors or transformers.
 2. Grounded Metal Conduit Communications Pathways:
 - a. 2-1/2-inches from electrical equipment and unshielded power lines carrying up to 2 kVA.
 - b. 6-inches from electrical equipment and unshielded power lines carrying from 2 kVA to 5 kVA.
 - c. 12-inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
 - d. 3-inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying from 2 kVA to 5 kVA.
 - e. 6-inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying more than 5 kVA.
- V. Unshielded Twisted Pair Termination:
1. Coil cables in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturers bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. Do not store more than 12-inches of UTP in an in-wall box, modular furniture raceway, or insulated walls. Loosely coil and store excess slack in accessible ceiling space above each drop location when there is not enough space present in the outlet box to store slack cable.
 2. Dress and terminate cables in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.1 document.
 3. Terminate four pair cables on the jack and patch panels using T568B wiring scheme.
 4. Maintain the cable jacket within 1-inch of the termination point.

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5. Do not exceed 0.5-inch of pair untwist at the termination point.
6. Do not exceed four times the outside diameter of the cable in the termination area for bend radiance compliance.
7. Neatly bundle and dress cables to their respective panels or blocks. Feed each panel or block by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

W. Testing Procedures:

1. Test cables and termination hardware for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-C. Verify pairs of each installed cable prior to system acceptance. Repair or replace any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels and connector blocks in order to ensure 100 percent useable conductors in cables installed.
2. Test cables in accordance with this document, the ANSI/TIA/EIA standards, the manufacturer's procedures and best industry practice. If any of these are in conflict, bring any discrepancies to the attention of the project team for clarification and resolution.
3. Test Unshielded Twisted Pair Cables as Follows:
 - a. Test twisted-pair copper cable links for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance. Test horizontal cabling using a Level IV test unit for Category 5e or 6 performance compliance as specified in ANSI/TIA/EIA-568 C.
 - b. Continuity: Test each pair of each installed cable using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Test shielded/screened cables with a device that verifies shield continuity in addition to the above stated tests. Record the test as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures and referenced to the appropriate cable identification number and circuit or pair number. Correct or repair any faults in the wiring and retest the cable prior to final acceptance.
 - c. Length: Test each installed cable link for installed length using a TDR type device. Test the cables from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length will conform to the maximum distances set forth in the ANSI/TIA/EIA-568-C Standard. Record cable lengths, referencing the cable identification number and circuit or pair number. For multipair cables, record the shortest pair length as the length for the cable.
4. Follow the Standards requirements established in ANSI/TIA/EIA-568-C.
5. Perform testing with a Level IV tester. The basic tests required are:
 - a. Wire Map
 - b. Length
 - c. Attenuation

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- d. NEXT (Near-end Crosstalk)
 - e. Return Loss
 - f. ELFEXT Loss
 - g. Propagation Delay
 - h. Delay Skew
 - i. PSNEXT (Power Sum Near-end Crosstalk Loss)
 - j. PSELFEXT (Power Sum Equal Level Far-end Crosstalk Loss)
6. Provide test results in electronic format, with the following minimum information per cable:
- a. Circuit ID
 - b. Test Result, "Pass" or "Fail"
 - c. Date and Time of Test
 - d. Project Name
7. Provide an electronic copy of the test results, in the native tester software format, to the Architect along with the printed test results.
8. Provide a fully functional version of the tester software for use by the Architect in reviewing the test results.
- X. Labeling:
- 1. Label horizontal cables using a machine printed label at each end of the cable at approximately 6-inches of the termination point. Do not use handwritten labels.
 - 2. Label patch panel ports and TO ports with the cable identifier.
 - 3. Labels to be Telecom Room number, patch panel number and patch panel port number. Provide the final cable ID matrix to the Architect for approval one week prior to cable installation.
 - 4. Note labeling information at each outlet on the record drawings.
- Y. Coordination of Conditions: Structured cabling for wireless access points of a given description may be used in more than one type of ceiling or wall structure. Coordinate ceiling construction, wall types, recessing depth and other construction details prior to ordering special components indicated in the details for shipment. Where materials supplied do not match ceiling construction replace them at no cost to Owner.
- 3.2 Station Cabling
- A. Reference 3.01, General Installation Requirements.
 - B. Install per manufacturer's instructions and recommendations.

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3.3 MODULAR JACKS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.4 Work Area Outlets

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.5 Patch Panels

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.6 PATCH CORDS

- A. Field terminated patch cords and jumpers are not allowed. At a minimum, provide equipment connection cords for one-half the total number of cables installed at each termination point. For example: A telecommunications outlet with four Category 6 cables installed would require two Category 6 equipment connection cords at the work area outlet and two Category 6 equipment connection cords in the telecommunications equipment room for a total of four Category 6 equipment connection cords.

END OF SECTION

SECTION 31 2000

EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Specifications for the excavation, filling, recompacting, grading and disposal of excess material.
- B. Related Sections
 - 1. Section 31 23 24, "Trenching and Backfilling"

1.2 REFERENCED STANDARDS

- A. ASTM International
 - 1. ASTM C136-84a: Standard Method for Sieve Analysis of Fine and Coarse Aggregate
 - 2. ASTM D1557: Laboratory Compaction Characteristics of Soil Using Modified Effort
 - 3. ASTM D2922: Density of Soil and Soil-Aggregate in Place by Nuclear Methods

- B. Caltrans – State of California Standard Specifications; latest edition

1.3 DEFINITIONS

- A. Compaction
 - 1. The degree of compaction is specified as percent compaction. Maximum densities refer to the maximum laboratory dry soil densities obtainable at optimum moisture content as determined by ASTM D1557.
 - 2. Percent compaction (relative compaction) is the ratio of the measured field dry density to the laboratory maximum dry density.
- B. Excavation Slope: Excavation slope shall be defined as an inclined surface formed by removing material from below existing grade.

1.4 SUBMITTALS

- A. Product Data
 - 1. Fill materials
 - 2. Source of concrete and aggregate for approval
- B. Test Reports
 - 1. Gradation (ASTM C136)
 - 2. Density-In-Place (ASTM D2922)

PART 2 - PRODUCTS

2.1 FILL MATERIALS

- A. Class 2 Aggregate Base: Class 2 aggregate base for subsequent backfill and/or pavement base to be inches maximum Class 2 aggregate base conforming to Caltrans, Section 26.

PART 3 - EXECUTION

3.1 CONSTRUCTION

- A. Surplus Material: Unless otherwise specified, surplus excavated material shall be disposed of off-site in accordance with applicable ordinances and environment requirements at the expense of the Contractor.
- B. Hauling
 1. When hauling is down over highways or city streets, loads shall be trimmed and the vehicle shelf areas shall be cleaned after each loading.
 2. Loads shall be watered after trimming to eliminate dust.
- C. Subgrade: Unless directed otherwise on the drawings, existing subgrade shall be compacted to 90% RC, 12" in depth, prior to placement of base material.
- D. Finish Grading
 1. Finish surfaces shall be smooth, compacted and free from irregularities. The degree of finish shall be that normally obtainable with a blade-grader.
 2. Finish grades shall be as specified on the plans, except where a local change in elevation is required to match existing conditions, or to ensure proper drainage.
 3. When the work is at an intermediate stage of completion, lines and grades shall be as specified within ± 0.1 foot or as necessary to provide adequate drainage.

3.2 FIELD QUALITY CONTROL

- A. Fill material shall be placed in horizontal layers and compacted with power tampers, rollers, idlers, or vibratory equipment. Material type, maximum layer depth, relative compaction, and general application are specified in Table A, below. Unless otherwise specified, fill classes shall be used where specified in Table A under General Application.

Table A: Fill Classification

Material Type	Maximum Uncompressed Layer Depth (Inches)	Minimum Relative Compaction (Percent)	General Application
Aggregate Base	4	95	Sidewalk, AC Pavement

3.3 TESTS

- A. Inspection Trenches
 1. Owner will direct Contractor to construct inspection trenches in compacted or consolidated backfill to determine that Contractor has complied with these Specifications.

END OF SECTION

SECTION 31 2319

DE-WATERING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Specifications and procedure for the de-watering of excavations and disposal of water.

1.2 SUBMITTALS

- A. Prior to installation of the de-watering system, submit shop drawings and design data indicating the following:
 1. The proposed type of de-watering system
 2. Arrangement, location and depths of system components
 3. Complete description of equipment and instrumentation to be used, with installation, operation and maintenance procedures
 4. Methods of disposal of pumped water
 5. Necessary permits for water disposal

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Furnish all materials, tools, equipment, facilities, and services as required for providing the necessary de-watering work and facilities.
- B. Provide backup equipment as necessary for the replacement and for unanticipated emergencies.

PART 3 - EXECUTION

3.01 DE-WATERING

- A. Keep excavation reasonably free from water during construction.
- B. Disposal of water shall not damage property or create a public nuisance.
- C. Have on hand pump equipment and machinery in good working condition for emergencies and workmen available for its operation.
- D. De-watering systems shall operate continuously until trenches are backfilled.
- E. Groundwater shall be controlled to prevent softening of the bottom of excavations, or formation of "quick" conditions.
- F. De-watering systems shall not remove natural soils.
- G. Control surface runoff to prevent entry or collection of water excavations.
- H. Release of groundwater shall be controlled to prevent disturbance of the natural foundation soils or compact fill.

- I. There shall be no discharge of turbid or hazardous water on site.
- J. Discharge or disposal of water shall be controlled to prevent erosion.

END OF SECTION

SECTION 32 2333

TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Specifications for excavating, backfilling, compacting, and surface restoration for the installation of pipe and pipeline appurtenances

1.2 RELATED SECTIONS

- A. Section 31 23 19 - De-watering

1.3 REFERENCES

- A. California Uniform Plumbing Code - Latest Edition
- B. Caltrans Standard Specifications and Drawings - Latest Edition

1.4 SUBMITTALS

- A. Product data for manufactured materials, including backfill, tracer wire, and warning tape

PART 2 - PRODUCTS

2.1 BACKFILL MATERIAL

- A. Import Backfill: Class 2 Aggregate Base, unless otherwise noted.
- B. Bedding Materials: Sand in accordance with the Standard Specifications, Paragraph 19-3.025B.
- C. Controlled Density Fill (CDF):
 - 1. Materials:
 - Cement: ASTM C150, Type II or V.
 - Aggregate shall consist of fine aggregate, with or without coarse aggregate, with a maximum size of 1-inch, free of clay, organics, and other deleterious materials. Less than 10 percent by weight shall pass the No. 200 sieve, and materials passing the No. 40 sieve shall be nonplastic as determined in accordance with ASTM D4318.
 - Water: Potable.
 - Fly Ash: ASTM C618, Class F unless otherwise approved.

2.2 PIPING MATERIAL

- A. All piping material shall conform to respective utility agency and the California Uniform Plumbing Code.

2.3 BURIED WARNING AND IDENTIFICATION TAPE

- A. Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3-inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, 'CAUTION, BURIED (intended service) LINE BELOW' or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.
1. Warning Tape Color Codes - Blue: Water Systems.
 2. Warning Tape for Metallic Piping: Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. 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: Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. 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. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.4 DETECTION WIRE FOR NON-METALLIC PIPING

- A. Detection wire shall be insulated single strand, solid copper wire with a minimum of 12 AWG.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. A. General:
1. Keep trench dry throughout construction operations
 - a. It should be presumed that the presence of groundwater will require dewatering operations. Furnish, install, maintain, and operate all necessary pumping and other equipment for dewatering all excavations. At all times have on the project sufficient pumping equipment for immediate use, including standby pumps for use in case other pumps become inoperable.
 - b. Provide a sufficient number of pumps so as to hold the groundwater level at an elevation of not less than 1 foot below the lowest elevation of the pipe, duct or other material to be placed.
 - c. Dispose of water in such a manner as to cause no injury or nuisance to public or private property, or be a menace to the public health.
 - d. The dewatering operation shall be continuous, so that the excavated areas shall be kept free from water during construction, while concrete is setting and achieves full strength, and until backfill has been placed to a sufficient height to anchor the work against possible flotation.
 - e. Continue dewatering during backfilling operations such that the groundwater is at least 1 foot below the level of the compaction effort at all times. No compaction of saturated materials will be allowed.
 - f. Dewatering devices must be adequately filtered to prevent the removal of fines

- from the soil.
- g. The Contractor shall be responsible for any damage to the foundations or any other parts of existing structures or of the new work caused by failure of any part of the Contractor's protective works. After temporary protective works are no longer needed for dewatering purposes, they shall be removed by the Contractor.
 - h. If pumping is required on a 24-hour basis, requiring engine drives, then engines shall be equipped in a manner to keep noise to a minimum.
 - i. Prevent disposal of sediments from the soils to adjacent lands or waterways by employing whatever methods are necessary, including settling basins.
- 2. Trench excavation shall follow the alignment of the pipe or utility centerline
 - 3. No more than 100 LF of trench shall be open at one time
 - 4. The Contractor shall be responsible for furnishing temporary drainage facilities to convey and dispose of surface water falling on or passing over the site.
 - 5. The Contractor shall shore all trenches in conformance with OSHA and State Safety Standards
 - 6. As directed by the Engineer, the surface course of trench restoration shall extend to the lip of gutter if the edge of trench is within 4 feet of the lip of gutter, and to the edge of pavement if the edge of trench is within 4 feet of an unpaved shoulder.
 - 7. Place asphalt concrete in 3-inch max, lifts, except final lift shall be 2.5-inch max.
 - 8. The trench edges shall be trimmed to a neat line as required by the Engineer. Trimming shall be by sawcut or rotary grinder.
- B. Shoring and Bracing:
- 1. Contractor is responsible for any damage or injury resulting from his construction operations. Contractor shall perform, at his own expense, all necessary repair work or reconstruction.
 - 2. Contractor will be responsible for all shoring with bracing design and installation.
- C. Excavation Required Beyond Trench Limits:
- 1. Excavation (bell holes) where necessary in the sides and bottom of the trench at pipe joint locations shall be large enough to make joints and permit inspection.
 - 2. Excavation to a greater depth than shown on the plans may be ordered by the Project Engineer if the native material at the bottom of the trench will not provide proper support for the pipe or if the excavation is in rock.
 - 3. Remove all adjacent, saturated material where pipeline leaks occur.
- 3.2 UTILITIES
- A. Location
- 1. Approximate known locations of underground utilities and structures are indicated on the plans. Contractor shall determine exact location of underground utilities and structures prior to construction.
 - 2. Adjustments of pipe alignment and elevation will be authorized by the Owner where exploratory work indicates the need.
- B. Excavation Around Utilities
- 1. Excavation and other work under or adjacent to utilities shall not interfere with their safe operations and use.
 - 2. Probe carefully to determine the exact location of utility and hand excavate where necessary to avoid damage.

3. In the event of damage incurred during construction near such structures or property, Contractor shall immediately notify the Owner and other appropriate utility or public safety authorities and shall arrange for immediate repairs at Contractor's expense.
- C. Tunneling Under Utilities
1. Tunneling may be allowed for short distances with the approval from the Project Engineer.
- 3.3 BLASTING
- A. Blasting will not be permitted.
- 3.4 BACKFILL OF TRENCHES
- A. Prior to backfilling, the trench shall be cleared of all wood and debris.
 - B. Backfill pipeline trenches to the level of the original ground surface or the underside of the pavement base course.
 - C. Backfill material shall not be dropped directly on the pipe.
 - D. Carefully remove timbering, sheeting, shoring and sheet piling, according to the instructions of the shoring system designer or the manufacturer, using methods that will minimize caving. If caving is occurring, the shoring system will be required to remain in place up to one to six inches above the top of the pipe.
 - E. Jetting of trench backfill is not permitted.
 - F. If trench has been excavated below the specified depth, that portion of the trench shall be backfilled with Class 2 or select material and compacted before pipe installation, at the Contractor's expense.
 - G. If pipe or conduit has less than 18 inches of final cover, trench shall be backfilled with Control Density Fill (CDF) to a depth specified by the Engineer.

END OF SECTION

SECTION 32 3113

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Chain-link fences.
2. Swing gates.

- B. Related Requirements:

1. Section 03 3000 "Cast-in-Place Concrete" for cast-in-place concrete equipment bases/pads for gate operators and controls and post footings.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
2. Review sequence of operation for each type of gate operator.
3. Review coordination of interlocked equipment specified in this Section and elsewhere.
4. Review required testing, inspecting, and certifying procedures.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Fence and gate posts, rails, and fittings.
 - b. Chain-link fabric, reinforcements, and attachments.
 - c. Gates and hardware.

- B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, provide the following information when available:
 - a. Environmental Product Declarations:
 - b. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

- C. Shop Drawings: For each type of fence and gate assembly.

1. Include plans, elevations, sections, details, and attachments to other work.

2. Include accessories, hardware, gate operation, and operational clearances.
- D. Samples for Initial Selection: For each type of factory-applied finish.
- E. Samples for Verification: For each type of component with factory-applied finish, prepared on Samples of size indicated below:
 1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer and factory-authorized service representative.
- B. Product Certificates: For each type of chain-link fence, and gate.
- C. Product Test Reports: For framework strength according to ASTM F 1043, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
- D. Field quality-control reports.
- E. Sample Warranty: For special warranty.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing fence grounding; member company of NETA or an NRTL.
 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
- B. Emergency Access Requirements: According to requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Failure to comply with performance requirements.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - c. Faulty operation of gate operators and controls.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Chain-link fence and gate frameworks shall withstand the design wind loads and stresses for fence height(s) and under exposure conditions indicated according to ASCE/SEI 7.
 - 1. Design Wind Load: As indicated on Drawings.
 - a. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified.
- B. Lightning Protection System: Maximum resistance-to-ground value of 25 ohms at each grounding location along fence under normal dry conditions.
- C. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section where available.
 - 1. Environmental Product Declarations:
 - 2. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- D. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 - 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.

2.2 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selavage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:
 - 1. Fabric Height: As indicated on Drawings.
 - 2. Steel Wire for Fabric: Wire diameter of 0.192 inch.
 - a. Mesh Size: 2 inches.
 - 1) Zinc-Coated Fabric: ASTM A392, Type II, Class 2, 2.0 oz./sq. ft. with zinc coating applied after weaving.
 - b. Mesh Size: 1 inch.
 - 1) Polymer-Coated Fabric: ASTM F668, Class 2a over zinc-coated steel wire.
 - c. Color: As selected by Architect from manufacturer's full range, according to ASTM F934.
 - 3. Selvage: Knuckled at both selvages.

2.3 FENCE FRAMEWORK

- A. Posts and Rails: ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:
 - 1. Fence Height: As indicated on Drawings.
 - 2. Horizontal Framework Members: top and bottom rails according to ASTM F 1043.
 - a. Top Rail: 1.66 inches in diameter.
 - 3. Round posts:
 - a. Heavy Industrial Strength: Material Group IA, round steel pipe, Schedule 40.
 - 1) Line Post: 2.375 inches in diameter.
 - 2) End, Corner and Pull Post: 2.375 inches in diameter.
 - 4. Square posts:

- a. Heavy-Industrial-Strength Material: Group IV, Alternative Design.
 - 1) Line Post: 4 inch square.
 - 2) End, Corner and Pull Post: 4 inch square.
 - 3) Finish: Powdercoat.
- 5. Brace Rails: Comply with ASTM F 1043.
- 6. Metallic Coating for Steel Framework:
 - a. Type A: Not less than minimum 2.0-oz./sq. ft. average zinc coating according to ASTM A 123/A 123M or 4.0-oz./sq. ft. zinc coating according to ASTM A 653/A 653M.
 - b. Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.
 - c. External, Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil-thick, zinc-pigmented coating.
 - d. Type C: Zn-5-Al-MM alloy, consisting of not less than 1.8-oz./sq. ft. coating.
 - e. Coatings: Any coating above.

2.4 SWING GATES

- A. General: ASTM F 900 for gate posts and double swing gate types.
 - 1. Gate Leaf Width: As indicated.
 - 2. Framework Member Sizes and Strength: Based on gate fabric height as indicated.
 - a. Match existing fencing materials.
- B. Pipe and Tubing:
 - 1. Zinc-Coated Steel: ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framework.
 - a. Powdercoated.
 - 2. Gate Posts: Square steel Posts.
 - 3. Gate Frames and Bracing: Square steel Posts.
- C. Frame Corner Construction: Welded.
- D. Hardware:
 - 1. Hinges: 360-degree self closing.
 - 2. Lock: Manufacturer's standard internal device.
 - 3. Closer: Manufacturer's standard.
 - 4. Door handle: Lever handle.

2.5 FITTINGS

- A. Provide fittings according to ASTM F 626.
- B. Post Caps: Provide for each post.
- C. Rail and Brace Ends: For each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
 - 1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
 - 2. Rail Clamps: Line and corner boulevard clamps for connecting bottom rails to posts.
- E. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:
 - a. Hot-Dip Galvanized Steel: 0.148-inch-diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

F. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. of zinc.

2.6 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating, and that is recommended in writing by manufacturer for exterior applications.

2.7 GROUNDING MATERIALS

- A. Comply with requirements in Section 26 0526 "Grounding and Bonding for Electrical Systems."
- B. Connectors and Grounding Rods: Listed and labeled for complying with UL 467.
 1. Connectors for Below-Grade Use: Exothermic welded type.
 2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
 1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 CHAIN-LINK FENCE INSTALLATION

- A. Install chain-link fencing according to ASTM F 567 and more stringent requirements specified.
- B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Exposed Concrete: Extend 2 inches above grade; shape and smooth to shed water.
- D. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of as indicated on Drawings.
- E. Line Posts: Space line posts uniformly at 10 feet (3 m) o.c.
- F. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
 1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- H. Intermediate and Bottom Rails: Install and secure to posts with fittings.
- I. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1-inch bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.
- K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
 1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.
- L. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side.

3.4 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.5 GROUNDING AND BONDING

- A. Comply with requirements in Section 26 0526 "Grounding and Bonding for Electrical Systems."

- B. Gate Grounding:
 - 1. Ground fence on each side of gates and other fence openings.
 - a. Bond metal gates to gate posts.
 - b. Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.
- C. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a ground rod located a maximum distance of 150 feet on each side of crossing.
- D. Fences Enclosing Electrical Power Distribution Equipment: Ground according to IEEE C2 unless otherwise indicated.
- E. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.
- F. Connections:
 - 1. Make connections with clean, bare metal at points of contact.
 - 2. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 3. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 - 4. Make above-grade ground connections with mechanical fasteners.
 - 5. Make below-grade ground connections with exothermic welds.
 - 6. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- G. Bonding to Lightning Protection System: Ground fence and bond fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor according to NFPA 780.
- H. Comply with requirements in Section 26 4113 "Lightning Protection for Structures."

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests.
- B. Grounding Tests: Comply with requirements in Section 26 4113 "Lightning Protection for Structures."
- C. Prepare test reports.

3.7 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION

SECTION 33 5600

FUEL STORAGE TANK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Specifications and procedure for furnishing, providing all labor, materials, equipment, and installation for the fuel storage tank.

1.2 RELATED SECTIONS

- A. Section 03 30 00 Cast-In-Place Concrete

1.3 REFERENCES

- A. Underwriters Laboratories Inc. (UL) UL 2085, UL 467, UL 142
- B. California Uniform Plumbing Code - Latest Edition
- C. NFPA 30-30A

1.4 SUBMITTALS

- A. Submit shop drawings and design data for fuel storage tank and appurtenances.
- B. Product data for manufactured materials

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Furnish all materials, tools, equipment, facilities, and services as required for providing the fuel storage tank and appurtenances.
- B. Fuel storage tank shall be Envirosafe double-walled, above-ground or Engineer approved equivalent to include the following:
 1. Split Tank Mounted on Saddles (300 gasoline / 800 Diesel).
 2. 2ea. 6" 8 Oz Emergency Vents
 3. 4" 8 Oz Emergency Vents
 4. 2ea. 2" Stack Vent (12' above grade) w/ 2" Mushroom Cap
 5. 2ea. 7.5 Gal Overspill with Lockable Cap. EQ 726
 6. 2ea. Valve Pressure Fill Overfill Prevention 2 Aluminum Body w/ 3 Male Quick Disconnect x 4 Female Threads
 7. 2ea. Cap Dust 3 for use with Adaptors-Aluminum
 8. 2ea. Overfill Valve Test Mechanism
 9. 2ea. Diffuser Threaded 2
 10. 2ea. Monitoring Well w/ 2" Cap
 11. 2ea. 818 Clock Gauge w/ Standard Float
 12. Engineered Hurricane Tie Down

13. Interstitial Leak Gauge
14. Tank Decal Kit
15. Envirolastic 940 DTM Polyaspartic Urethane for High Performance Finish or Engineer approved equivalent
16. FR701VA, 3/4" x 12' Hose, 3/4" Automatic Nozzle (unleaded spout and red cover),
17. 807C Gallon Meter
18. 1 FR711VA Pump 20 GPM High Flow 1" x 18' Hose, 1 Ultra High Flow Nozzle, 901 Gal.
19. Meter
20. Husky 3/4" Breakaway & Husky 3/4" Swivel or Engineer approved equivalent
21. Husky 1" Breakaway & Husky 1" Swivel or Engineer approved equivalent
22. Cim-Tek 1" Filter Adapter & 3/4" Filter or Engineer approved equivalent
23. Cim-Tek 1.5" Filter Adapter & 1" Filter or Engineer approved equivalent
24. 2ea. Bracket, Piping, Ball Valve & Anti-Syphon Valve
25. 2ea. 18" Man way for easy inner tank accessibility
26. UL 2085 Labeled & Listed
27. 2ea. Step ladder with Platform
28. Dual Bulkhead (Split System)
29. STEEL THICKNESS 3/16" SHELL, 1/4" PRIMARY HEAD, 5/16 SECONDARY HEAD
30. 3/4" Replacement Fuel Filters (Qty. 12)
31. 1" Replacement Fuel Filters (Qty. 6)
32. Touch-up Paint
33. Owner's Manual
34. Fire Extinguisher as approved by the Engineer
35. Calibrated dip stick

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Tank shall be installed on a level concrete pad as indicated in plans. All concrete work shall conform to the plans and manufacturer's recommendations for a Cylindrical Aboveground Tank Foundation requirement and Seismic Zone.
- B. Install tank appurtenances in accordance with the respective manufacturer's instructions.
- C. All proper permits, including electrical, shall be secured prior to project startup.
- D. Furnish a fire extinguisher suitable for aboveground gasoline/diesel tank mounted in an appropriate location inside of the fence.
- E. One (1) calibrated dip stick to indicate fuel level in the tank.

END OF SECTION