



**CITY OF HERMOSA BEACH
CONTRACT DOCUMENTS AND SPECIFICATIONS
FOR**

CIP NO. 689 CLARK BUILDING RENOVATIONS

April 2024

**City of Hermosa Beach
NOTICE INVITING BIDS**

Notice is hereby given that the City of Hermosa Beach will receive electronic bids until **2:00PM on Wednesday, May 29, 2024**, at which time the electronic bids will be publicly opened at the City Council Chambers at 1315 Valley Drive, Hermosa Beach, CA 90254 and posted on Planet Bids for **CIP No. 689 Clark Building Renovations. A mandatory pre-bid walk is scheduled for Wednesday, May 8, 2024, at 2:00 P.M. in front of Clark Building, 861 Valley Drive, Hermosa Beach, CA 90254.**

The project generally includes, but is not limited to:

- New commercial kitchen per current Los Angeles County Department of Public Health requirements, including new appliances, fixtures, storage cabinets, counter tops, flooring, grease trap system, and lighting;
- New electric heating, ventilation, and air conditioning (HVAC) system;
- New audio-visual system including built-in speakers, overhead projector, and roll-down projection screen;
- Architectural upgrades including, but not limited to:
 - Furred out walls to hide items such as electrical conduit and provide a new smooth wall surface throughout,
 - New decorative accents on the ceiling,
 - Acoustic ceiling panels for sound absorption,
 - New commercial grade vinyl flooring,
 - New interior and exterior light fixtures,
 - Complete interior and exterior cleaning and painting, and
 - Restored original signage on the exterior of the building;
- New waste line, grease interceptor and connection to the existing sewer lateral;
- New plumbing system to accommodate the updated restrooms and commercial kitchen, including new floor drains for ease in maintenance;
- Site improvements including new concrete walkways and ramps to current accessibility standards, decorative enclosures around the refuse storage area and HVAC units, new accessible entrance to the Lawn Bowling Club, and refreshed landscaping and irrigation.
- Completely renovated restrooms to current accessibility standards, including new fixtures, partitions, vanities, mirrors, flooring, and lighting;
- New electrical system including wiring and upgraded service connection necessary to serve the enhanced building components;
- Asbestos and lead abatement work throughout the building; and
- Necessary demolition work associated with the renovation.

The engineer's cost estimate for the project is \$2,400,000.00. The license requirement is a valid **State of California Contractors License Class "B"**.

The duration of the project is **one-hundred and twenty (120) working days**. All bids must be submitted electronically on Planet Bids Portal, accessible through the City's webpage at <https://www.hermosabeach.gov/our-government/city-clerk/bids-and-proposals> where the bidder

must first register as a vendor through our Planet Bids Portal. Contract Documents, plans, and specifications will be available for review on Planet Bids. All relevant materials shall be obtained from the link above.

Each proposal must be accompanied by a cash deposit, a certified or cashier's check, or a Bidder's bond, made payable to the City of Hermosa Beach, in an amount not less than 10 percent of the total bid submitted.

The successful Bidder will be required to furnish a faithful performance bond in the amount of 100 percent of the Contract price and a payment bond in the amount of 100 percent of the Contract price in the attached forms, satisfactory to the City Attorney. The successful Bidder will also be required to pay the State of California prevailing wage scale as determined by the Department of Industrial Relations, available at <https://www.dir.ca.gov/OPRL/DPreWageDetermination.htm>

The Contractor must be registered with the Department of Industrial Relations at the time of bid. Contractor's registration information is available at: <https://www.dir.ca.gov/Public-Works/Contractor-Registration.html>

The City reserves the right to reject any or all bids and to waive any informality or irregularity in any bid received and to be the sole judge of the merits of the respective bids received. The award, if made, will be made to the lowest responsive and responsible Bidder.

Please submit any questions related to this bid on Planet Bids portal no later than **12:00PM on Tuesday, May 14, 2024.**

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MATERIAL REPORT PROVIDED BY ELISS ENVIRONMENTAL
DATED OCTOBER 11, 2022)**

CIP No. 689 CLARK BUILDING RENOVATIONS

I. PROJECT DESCRIPTION AND UNDERSTANDING

The project generally includes, but is not limited to:

- New commercial kitchen per current Los Angeles County Department of Public Health requirements, including new appliances, fixtures, storage cabinets, counter tops, flooring, grease trap system, and lighting;
- New electric heating, ventilation, and air conditioning (HVAC) system;
- New audio-visual system including built-in speakers, overhead projector, and roll-down projection screen;
- Architectural upgrades including, but not limited to:
 - Furred out walls to hide items such as electrical conduit and provide a new smooth wall surface throughout,
 - New decorative accents on the ceiling,
 - Acoustic ceiling panels for sound absorption,
 - New commercial grade vinyl flooring,
 - New interior and exterior light fixtures,
 - Complete interior and exterior cleaning and painting, and
 - Restored original signage on the exterior of the building;
- New waste line, grease interceptor and connection to the existing sewer lateral;
- New plumbing system to accommodate the updated restrooms and commercial kitchen, including new floor drains for ease in maintenance;
- Site improvements including new concrete walkways and ramps to current accessibility standards, new access ramp on Valley Drive, decorative enclosures around the refuse storage area and HVAC units, new accessible entrance to the Lawn Bowling Club, and refreshed landscaping and irrigation.
- Completely renovated restrooms to current accessibility standards, including new fixtures, partitions, vanities, mirrors, flooring, and lighting;
- New electrical system including wiring and upgraded service connection necessary to serve the enhanced building components;
- Asbestos and lead abatement work throughout the building; and
- Necessary demolition work associated with the renovation.
- All kitchen appliances and equipment shall be provided by the contractor
- Awarded contractor must pay the building permit. The building permit fee will be no more than \$1,500.00. No other permit fees will be required.

II. NOTICE TO BIDDERS

Prospective Bidder: To be considered as a responsive Bidder you must register on Planet Bids portal through the city's website at <https://www.hermosabeach.gov/our-government/city-clerk/bids-and-proposals>.

Mandatory Pre-bid Meeting: There will be a mandatory pre-bid meeting at **2:00PM on Wednesday, May 8, 2024, at Clark Building at 861 Valley Drive, Hermosa Beach, CA 90254**. The City will respond to questions from prospective Bidders at that time. Attendance at this meeting is required in order to submit a bid.

Bid Documents: Bid Documents, including but not limited to specifications and proposal forms, will be available for download on Planet Bids Portal, accessible through the webpage at: <https://pbsystem.planetbids.com/portal/51313/bo/bo-search>.

To the extent required by Section 20103.7 of the Public Contract Code, upon request from a Contractor plan room service, the City shall provide an electronic copy of the Contract Documents at no charge to the Contractor plan room.

It is the responsibility of each prospective Bidder to download and print all bid documents for review and to verify the completeness of Bid Documents before submitting a bid. The City does not assume any liability or responsibility based on any defective or incomplete copying, excerpting, scanning, faxing, downloading, or printing of the Bid Documents.

Questions: All questions regarding this bid shall be submitted through Planet Bids no later than **12:00PM on Tuesday, May 14, 2024**. Proposers shall not contact City personnel or Elected Officials with any questions or clarifications concerning this Invitation for Bids other than through Planet Bids. Any City response for this Bid that is not posted through Planet Bids is unauthorized and will be considered invalid.

Submittal of Bids: Electronic bids shall be submitted through Planet Bids until **2:00PM on Wednesday, May 29, 2024** at which time they will be publicly opened and read in the City Council Chambers at 1315 Valley Drive, Hermosa Beach, CA. All bids shall be valid for a period of 90 calendar days after the bid opening date.

Bidder's Guarantee: Each bid must be accompanied by cash or a certified check or a cashier's check or Bidder's bond made payable to the City of Hermosa Beach for an amount equal to at least ten percent (10%) of the bid price. In accordance with Public Contract Code Section 20170, the Bidder's Bond shall be issued by a surety company admitted to do business in the State of California. Further, in accordance with Public Contract Code Section 20172, such guarantee shall be forfeited should the Bidder to whom the Contract is awarded fail to enter into the Contract within the specified time.

Payment, Performance Bonds: The successful Bidder will be required to furnish a Faithful Performance Bond and a Labor and Material Payment Bond, each in an amount equal to one hundred percent (100%) of the Contract Price. Each bond shall be in the forms set forth herein and shall be secured from a surety company that meets all State of California bonding requirements, as defined in California Code of Civil Procedure Section 995.120, and that is a California admitted surety insurer.

Substitution of Securities: Pursuant to Section 22300 of the Public Contract Code of the State of California, the successful Bidder may substitute certain securities for funds withheld by the City to ensure its performance under the Contract.

Contractor License: In accordance with provisions of Section 3300 of the California Public Contract Code, City of Hermosa Beach has determined that the **Contractor shall possess a valid “B” California Contractor’s License**. Failure to possess such license may render the bid as non-responsive and bar the award of the Contract to that non-responsive Bidder.

Prevailing Wages: Pursuant to Labor Code Section 1773, the Contractor shall pay the prevailing rate of per diem wages and the prevailing wage rate for holiday and overtime work applicable in Los Angeles County from the Director of the Department of Industrial Relations for each craft, classification, or type of worker needed to execute this Contract. A copy of these prevailing wage rates may be obtained by visiting: <https://www.dir.ca.gov/Public-Works/Prevailing-Wage.html>

In addition, a copy of the prevailing rate of per diem wages will be made available at the City’s Public Works Department upon request. The successful Bidder shall post a copy of the prevailing wage rates at each job site. It shall be mandatory for the Bidder to whom the Contract is awarded, and for any subcontractors, to comply with all Labor Code provisions, which include but are not limited to the payment of not less than the said specified prevailing wage rates to all workers employed by them in the execution of the Contract, employment of apprentices, hours of labor, and debarment of Contractors and subcontractors.

Contractor’s Registration with the Department of Industrial Relations (DIR): The Bidder’s attention is directed to Labor Code Section 1725.5, which provides that a Contractor or subcontractor shall not be qualified to bid on, be listed in a Bid proposal, subject to the requirements of Public Contract Code Section 4104, or engage in the performance of any Contract that is subject to Labor Code Section 1720 et seq., unless currently registered and qualified to perform public work pursuant to Labor Code Section 1725.5. No Bid will be accepted, nor any Contract entered into without proof of the Contractor’s and subcontractors’ current registration with the DIR to perform public work. If awarded a Contract, the Bidder and its subcontractors, of any tier, shall maintain active registration with the DIR for the duration of the Project.

Compliance Monitoring and Enforcement: Contractor’s performance of the Work described in the Notice Inviting Bids is subject to compliance monitoring and enforcement by the California Department of Industrial Relations. In bidding on this Project, it shall be the Bidder’s sole responsibility to evaluate and include the cost of complying with all labor compliance requirements under this Contract and applicable law in its Bid.

Award of Contract: The City shall award the Contract for the Project to the lowest responsive, responsible Bidder as determined by the City from the total base bid. City reserves the right to reject any or all bids or to waive any irregularities or informalities in any bids or in the bidding process.

III. INSTRUCTION TO BIDDERS

Form of Proposal: The proposal shall be fully executed and submitted on the forms provided by the City. Proposal forms can be obtained from Planet Bids.

Signatures: All places where signatures are required must be fully executed.

Proposal: Documents which shall be signed and returned to the City with the Bid Proposal are:

- A. Proposal
- B. Bid Schedule
- C. Bid Bond
- D. Bidder's Assurance
- E. Bidder's Declaration
- F. Certificate of Non-Discrimination by Contractors
- G. Certification of Principal
- H. Declaration of Eligibility to Contract
- I. Non-Collusion Declaration
- J. References for Work
- K. SubContractor List
- L. Iran Contracting Act Certification
- M. Public Works Contractor Registration Certification
- N. Addenda (if applicable)

Contract: Documents which shall be signed and returned to the City by the successful Bidder within 10 days of notification of intent to award Contract:

- A. Contract Agreement
- B. Agreement of Indemnification and Hold Harmless and Waiver of Subrogation and Contribution
- C. Equals
- D. Faithful Performance Bond
- E. Payment Bond (Labor and Materials)
- F. Guarantee to the City of Hermosa Beach
- G. General Comprehensive Liability Additional Insured Endorsement
- H. Automobile Liability Additional Insured Endorsement
- I. Instructions for Completing, Executing, and Submitting Evidence of Insurance to the Owner
- J. Worker's Compensation Insurance Certificate
- K. Supplemental Information to be Completed by Principal
- L. W-9 Form
- M. Copy of City Business License

Delivery of Proposal: Each Bid prepared by Bidder shall be completed in itself and shall be submitted electronically through Planet Bids.

Prevailing Wage: In accordance with the provisions of Section 1770 et seq., of the Labor Code, the Director of the Department of Industrial Relations of the State of California has

ascertained the general prevailing rate of wages which is the minimum amount which shall be paid to all workers employed to perform the work. A copy of the determination is on file in the office of the City Clerk and is hereby incorporated herein and made a part hereof as though fully set forth herein.

A copy of the determination will be made available to any interested person upon request and shall be posted at the job site.

Overtime: As per Labor Code Section 1810 et seq., eight (8) hours is the legal working day. The Contractor shall pay overtime for each worker who works in excess of the legal working day.

Payment: Refer to the Contract Agreement for payment information. Contractor shall submit progress payment requests on City approved form.

Required Bonds: Prior to the execution of the Contract, the successful Bidder shall file with the City surety bonds in the amounts and for the purposes noted below. The surety insurer shall be a California admitted surety insurer, as defined in Code of Civil Procedure section 995.120. Contractor shall pay all premiums and costs thereof and incidental thereto.

Per Civil Code section 3247, a Payment Bond is required if the Contract is for more than \$25,000.

The successful Bidder shall give three (3) surety bonds with good and sufficient sureties:

"Payment Bond – Labor and Materials" shall be so conditioned as to insure to the benefit of persons furnishing materials for or performing labor upon the work. Bond to be in the sum of not less than 100% of the Contract price to assure the claims of materialmen supplying materials to Contractor, and for payment to laborers and subcontractors employed on the project.

"Faithful Performance Bond" in the sum of not less than 100% of the Contract price to assure the faithful performance of the Contract; shall be conditioned as to assure the faithful performance by the Contractor of all work under said Contract, in a manner that is satisfactory and acceptable to the City; that all materials and workmanship supplied by him will be free from original or developed defects; and that should original or developed defects or failures appear, the Contractor shall, at his own expense, make good such defects and failures and make all replacements and adjustments required, within a reasonable time after being notified by the City to do so, and to the satisfaction of the City.

Rejection of Proposals: The City reserves the right to reject any and all proposals and to waive any minor or technical discrepancies or irregularities. Proposals may be rejected if they show any alteration of form, additions not called for, conditional bids, incomplete bids, erasures, or irregularities of any kind.

Agents: When proposals are signed by an agent, other than the officer or officers of a corporation authorized to sign Contracts on its behalf or a member of a partnership, a "Power of Attorney" must be on file with the City prior to opening bids or shall be submitted with the proposal; otherwise, the proposal will be rejected as irregular and unauthorized.

Withdrawal of Proposals: Any bid may be withdrawn at any time prior to the time fixed in the public notice for the opening of bids only by written request for the withdrawal of the bid filed with the City Engineer. The request shall be executed by the Bidder or their duly authorized representative. The withdrawal of a bid does not prejudice the right of the Bidder to file a new bid. Bids are opened exactly at the time fixed in the public notice for opening bids. A bid will not be received after that time, nor may any bid be withdrawn after that time. No Bidder may withdraw his bid within ninety (90) days after the actual date of the opening thereof.

Insurance: Without limiting Contractor's indemnification, Contractor shall maintain in force at all times during the performance of this agreement the insurance provisions set out in the Contract Agreement.

City Business License and Permits: The successful Bidder shall obtain a valid City of Hermosa Beach Business License prior to commencing work under this Contract.

The successful Bidder will be required to obtain City Right of Way Permit to work in public right-of-way, issued at no fee for the project.

Increased or Decreased Quantities: The City reserves the right to increase, or decrease, or to entirely eliminate items or portions of items from work if found desirable or expedient.

Approximate Estimate: The quantities in the Bid Schedule are approximate only, being given as a basis for the comparison of bids. The City does not, expressly or by implication, agree that the actual amount of work will correspond therewith. The Contractor shall verify in the field the accuracy of the estimated quantities.

Examination of Plans, Specifications, Contract, and Site of Work: The Bidder shall examine carefully the site of the work contemplated, the Plans and Specifications, and the proposal and Contract forms therefor. The submission of a bid shall be conclusive evidence that the Bidder has investigated and is satisfied as to the conditions to be encountered, as to the character, quality and scope of work to be performed, the quantities of materials to be furnished, and as to the requirements of the proposal, Plans, Specifications, and the Contract.

Where the City may have made investigations of subsurface conditions in areas where work is to be performed under the Contract, such investigations are made only for the purpose of study and design. Where such investigations have been made, Bidders or Contractors may, upon written request, inspect the records of the City as to such investigations subject to and upon the conditions hereinafter set forth. Such inspection of records may be made at the office of the City Engineer.

The records of such investigations are not a part of the Contract and are shown solely for the convenience of the Bidder or Contractor. It is expressly understood and agreed that the City assumes no responsibility whatsoever in respect to the sufficiency or accuracy of the investigations thus made, the records thereof, or of the interpretations set forth therein or made by the City in its use thereof and there is no warranty or guaranty, either expressed or implied, that the conditions indicated by such investigations or records thereof are representative of those existing throughout such areas, or any part thereof, or that unlooked

for developments may not occur, or that materials other than, or in proportions different than these indicated, may not be encountered.

Bidders shall satisfy themselves by personal examination of the locations of the proposed work, and by such other means as they may choose as to actual conditions and requirements and as to the accuracy of the quantities stated in the Proposal forms. Information derived from the maps, plans, specifications, profiles, or drawings, or from the Engineer or his assistants (or the Architects or their assistants), shall not relieve the Bidder of this responsibility, and the interpretation of the data disclosed by borings or other preliminary investigations is not guaranteed nor is any liability assumed by the City.

If a prospective Bidder is in doubt as to the true meaning or intent of any part of the Contract Documents including the Specifications, or discovers discrepancies in, or omissions from, the Specifications or Drawings, they may submit to the Engineer a written request for an interpretation or a correction thereof via Planet Bids. Interpretations or corrections of the Contract Documents including the Specifications and Drawings, shall be made only by addendum duly issued by the Engineer, and a copy of such addendum will be uploaded on Planet Bids and such addendum shall be considered a part of and incorporated in the Contract Documents.

Relief of Bidders: If the Bidder claims a mistake was made in their bid, the Bidder shall give the City written notice within five (5) days after the opening of the bids of the alleged mistake, specifying in the notice in detail how the mistake occurred.

Disqualification of Bidders: More than one proposal from an individual, firm, partnership, corporation, or combination thereof under the same or different names will not be considered. Reasonable grounds for believing that any individual, firm, partnership, corporation, or combination thereof is interested in more than one proposal for the work contemplated may cause the rejection of all proposals in which such individual, firm, partnership, corporation, or combination thereof is interested. If there is reason for believing that collusion exists among the Bidders, any or all proposals may be rejected. Proposals in which the prices obviously are unbalanced due to mathematical errors may be rejected.

Award of Contract: The award of the Contract, if it be awarded, will be to the lowest responsible Bidder whose proposal complies with all of the requirements prescribed. Such award, if made, will normally be made within in ninety (90) calendar days of the opening of the proposals.

If the lowest responsible Bidder refuses or fails to execute the Contract, the City may award the Contract to the second lowest responsible Bidder. If the second lowest responsible Bidder refuses or fails to execute the Contract, the City may award the Contract to the third lowest responsible Bidder.

Execution of Contract: The Contract shall be signed by the successful Bidder and returned, together with the Contract bonds, insurance endorsements and certificates, and all other required documents within ten (10) business days after the Bidder has received notice of intent to award.

Failure to Execute Contract: Failure of the lowest responsible Bidder, the second lowest responsible Bidder, or the third lowest responsible Bidder to execute the Contract and file acceptable bonds as provided herein within ten (10) business days after such Bidder has received notice that the Contract has been awarded to them shall be just cause for the forfeiture of the proposal guaranty. The successful Bidder may file with the City Engineer a written notice, signed by the Bidder, or his authorized representative, specifying that the Bidder will refuse to execute the Contract if presented to him. The filing of such notice shall have the same force and effect as the failure of the Bidder to execute the Contract and furnish acceptable bonds within the time herein above prescribed.

Return of Proposal Guaranties: Within ten (10) business days after the award of the Contract to the lowest responsible Bidder, the City will return the proposal guaranties, other than Bidder's bonds, accompanying such of the proposals as are not to be further considered in making the award. Retained proposal guaranties will be held until the Contract has been finally executed, after which all proposal guaranties, except Bidder's bonds and any guaranties which have been forfeited, will be returned to the respective Bidders whose proposals they accompany.

Qualifications of Bidders: Each Bidder shall be skilled and regularly engaged in the general class or type of work called for under the Contract. A statement setting forth their experience shall be submitted by each Bidder on the References of Work form provided herein.

Each Bidder shall possess valid active Contractor's License issued by the Contractor's State License Board at the time their bid is submitted. The class of license shall be applicable to the work specified in the Contract. Each Bidder shall also have no less than five (5) years' experience in the magnitude and the character of the work bid.

Pursuant to section 1103 of the Public Contract Code, City staff has determined that the following non-exhaustive experience is reasonably necessary to satisfactorily perform the public works Contract:

The Contractor shall have a minimum of five (5) projects of similar type of construction and magnitude with other public agencies within the past five (5) years.

The Contractor shall have been in the business under the same name and California Contractor's License for a minimum of five (5) continuous years prior to the bid opening date for this project. The license used to satisfy this requirement shall be of the same type as that required by the Contract.

The Contractor shall perform above 50% of the Contract with its own forces.

Bidders must be thoroughly competent and capable of satisfactorily performing the work covered by the proposal. They shall have had project experience similar to the project scope of work. When requested, they shall furnish such statements relative to previous experience on similar work, the plan or procedure proposed, and the organization, machinery, plant, and other equipment available for the contemplated work, and the financial condition and resources of the Bidder, as may be deemed necessary by the City Engineer in determining such competence and capability.

The City of Hermosa Beach will not enter into a Contract with any Bidder who is not properly licensed to do the work of this Contract under the provisions of Section 7000 et seq., of the Business and Professions Code, unless particularly exempted by the terms thereof. A bid by a Contractor who is not properly licensed shall be considered non-responsive and will be rejected. The Contractor must hold all sub-Contractors to these same Contract requirements.

The sheet for Bidder's signature in the Bid Proposal shall clearly show the Contractor's name, address, telephone number, State of California Contractor's license number, classification, and date of expiration.

Completeness of Bids: Bids are required for the entire work. The amount of the bid for comparison purposes will be the total bid price of all items. The Bidder shall set forth the bid price for each item in the respective spaces provided for these purposes.

In case of discrepancy between the unit price and the total set forth for the item, the unit price shall prevail, provided, however, if the amount set forth as a unit price is ambiguous, unintelligible or uncertain for any cause, or is omitted, or in the case where the unit price is the same amount as the entry in the "Total" column, then the amount set forth in the "Total" column for the item shall prevail in accordance with the following:

- a) As to lump sum items, the amount set forth in the "Total" column shall be the unit price.
- b) As to unit price items, the amount set forth in the "Total" column shall be divided by the estimated quantity for the item and the price thus obtained shall be the unit price.

The City may waive technical or non-substantive inconsistencies in any bid.

Non-discrimination: Pursuant to the provisions of 31 CFR, Part 51, Section 51.55, the Revenue Sharing Act, notice is hereby given of the following policy, effective immediately:

The City of Hermosa Beach does not discriminate on the basis of handicapped status in admission or access to, or treatment of, or employment in, its programs and activities. The office that will coordinate compliance is that of Human Resources.

Workers' Compensation Insurance: Before execution of this Agreement by the City, the Contractor shall file with the City's Risk Manager the following signed certification:

"I am aware of, and will comply with, Section 3700 of the Labor Code, requiring every employer to be insured against liability for Workers' Compensation or to undertake self-insurance before commencing any of the work."

The Contractor shall also comply with Section 3700 of the Labor Code by securing, paying for and maintaining in full force and effect for the duration of this Agreement, complete Workers' Compensation Insurance, and shall furnish a Certificate of Insurance to the City's Risk Manager reflecting such insurance before this Agreement becomes effective. Contractor shall fully indemnify and hold harmless City, its attorneys, agents, officers, and employees for any claims in law or equity occasioned by the failure of Contractor to

comply with the terms of this section. Every Workers' Compensation Insurance policy required hereunder, shall bear an endorsement, or shall have attached a rider, providing that in the event of expiration or proposed cancellation of such policy for any reason whatsoever, the City's Risk Manager shall be notified of such action by registered mail, postage prepaid, return receipt requested, at least 30 days before such expiration or cancellation becomes effective.

Indemnification: Bidders are instructed to refer to the Contract Agreement.

Subcontractors: Bidders must list the name, address of the place of business, Contractor license number, and DIR registration number for each subcontractor to be responsible for more than 1/2 of 1% of the total bid, and the portion of the job for which that subcontractor is responsible. Only one subcontractor may be listed for each portion of the job.

Unfair Business Practices Claims: In entering into a public works Contract or a subcontract to supply goods, services, or materials pursuant to a public works Contract, the Contractor or sub-Contractor 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. Section 15) or under the Cartwright Act (Chapter 2, (commencing with Section 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 the awarding body renders final payment to the Contractor without further acknowledgment by the parties. (Section 7103.5, California Public Contract Code.)

Bidder Registration Requirement: Pursuant to Labor Code sections 1725.5 and 1771.1, all Contractors and subcontractors that wish to bid on, be listed in a bid proposal, or enter into a Contract to perform public work must be registered with the Department of Industrial Relations (DIR). No bid will be accepted, nor any Contract entered into without proof of the Contractor's and subcontractors' current registration with the DIR to perform public work. If awarded a Contract, the Bidder and its subcontractors, of any tier, shall maintain active registration with the DIR for the duration of the Project. To this end, Bidder shall sign and submit with its bid proposal the Public Works Contractor Registration Certification on the form provided, attesting to the facts contained therein. Failure to submit this form may render the bid non-responsive. In addition, each Bidder shall provide the registration number for each listed subcontractor in the space provided in the Subcontractors List form.

Claim Procedures: Bidders are instructed to refer to the Contract Documents, including by way of illustration and not by limitation the Contract Agreement.

Protest Procedures: Bidders may file a "protest" of a bid proposal with the City's City Manager. In order for a Bidder's protest to be considered valid, the protest must:

- A. Be filed in writing within five (5) calendar days after the bid opening date;
- B. Clearly identify the specific irregularity or accusation;
- C. Clearly identify the specific City staff determination or recommendation being protested;

- D. Specify in detail the grounds for protest and the facts supporting the protest;
- E. Include all relevant supporting documentation with the protest at time of filing; and
- F. Be transmitted concurrently to all other parties with a direct financial interest that may be adversely affected by the outcome of the protest. Such parties shall include all other Bidders or proposers who appear to have a reasonable prospect of receiving an award depending upon the outcome of the protest.

If the protest does not comply with each of these requirements, the City may reject the protest with or without further review.

If the protest is timely and complies with the above requirements, the City Manager, or other designated City staff member, shall review the protest, any response from the challenged Bidder(s), and all other relevant information, and will provide a written decision to the protestor.

The City Manager or designee shall have up to ten calendar days to decide whether to approve or reject the protest. The written decision of the City Manager or designee on the protest shall be served upon the protesting Bidder and any Bidder subject to the protest within fourteen (14) calendar days of receipt of the bid protest. The City Manager or designee may extend the ten (10) calendar days if necessary, to review additional information requested from any Bidder.

If the protester wishes to further contest the protest, it shall appeal this decision to the City Council by filing a statement of appeal with the City Clerk within five (5) days of the issuance of the City Manager's decision. Said statement of appeal shall include all information required of the original bid protest, as well as a short and plain statement setting forth why Protester disputes the City Manager's decision and the legal and factual basis for such dispute. Any person or entity may present a formal protest to the City with respect to solicitations being conducted by staff.

A Bidder whose bid has been protested by another Bidder may submit to the City Manager a written response to the protest by email or by personal delivery or overnight mail to City Hall, 1315 Valley Drive, Hermosa Beach, California 90254, so that it is received by the City no later than seven calendar days after the protest has been served by the protesting Bidder.

1. Definitions

- a. "Bidder" means any person or firm providing a timely, written response to the City solicitation.
- b. "Bid Protest" means any protest with regard to the response submitted by another Bidder.
- c. "Response" means the written response to the City solicitation provided by a person or firm.
- d. "Solicitation Protest" means a statement of protest, dispute, challenge, disagreement, disapproval or other objection regarding documents,

determinations or actions taken or contemplated by the City with respect to a solicitation.

- e. "Solicitation" means the document by which the City identifies goods, equipment, services, or public construction projects for which it seeks a response.
2. Format – The protest must be in writing and include the following information at a minimum:
 - a. The name, address, and phone number of the protester, or the authorized representative of the protester;
 - b. The signature of the protester or authorized representative of the protester;
 - c. The project number and title under which the protest is submitted;
 - d. A detailed description of the legal and/or factual grounds for the protest and all supporting documentation. For protests containing elements not based on publicly released information the protest must contain documentation clearly showing the date on which the protester received the information; and
 - e. The form of relief requested.

3. State or Federal Funding

If the subject matter of the solicitation or project is receiving any state or federal funds which requires a protest procedure different than the procedures stated above, then that protest procedure shall control.

In the event there is any lawsuit filed against the City relating to any federally funded project, the City will provide prompt notice of that lawsuit to all agencies who participated in the funding of the project.

4. Mandatory Procedure

This administrative procedure and the time limits set forth herein are mandatory. Failure to comply with these mandatory procedures shall constitute a waiver of any right to pursue the bid protest, including filing a Government Code claim or any legal proceedings or actions.

IV. BID DOCUMENTS

A. PROPOSAL

CIP No. 689 CLARK BUILDING RENOVATIONS

CONTRACTOR: _____ Date: _____

TO: City of Hermosa Beach
Honorable Mayor and Members of the City Council City Hall
Hermosa Beach, California, 90254

Ladies and Gentlemen:

The undersigned declares that he/she has carefully examined the location of the proposed work and that he/she has examined the Plans and Specifications, has read the Contract Documents, and hereby agrees to furnish all labor, materials, equipment, tools, transportation, and services to do all work required for:

CIP No. 689 CLARK BUILDING RENOVATIONS

In accordance with the Plans and Specifications prepared by the Engineer, in accordance with the Special Provisions, the Contract Documents, and in accordance with the Standard Specifications for Public Works Construction 2021, Unified Building Code for Construction (current edition) (except Sections 1-9), and the requirements of the Engineer under said documents, for the prices shown herein.

The Contractor also certifies that he/she is registered with the Department of Industrial Relations.

All work shall be completed within 120 working days from the date the Notice to Proceed is issued by the Engineer.

Contractor Signature

PWCR Registration Number

B. BID SCHEDULE

CIP No. 689 CLARK BUILDING RENOVATIONS

Item No.	Estimated Quantity	Unit	Description of Work	Total
1	1	LS	Clark Building Renovations – Complete *	\$
Total Bid				\$

*SELECTED LOW BIDDER TO PROVIDE COMPLETE ITEMIZED SCHEDULE OF VALUES PER SECTION 012973 – SCHEDULE OF VALUES

(Total Bid in Figures) _____

(Total Bid in Words) _____

Contractor Name: _____

In case of any discrepancy between the words and the figures, the words shall prevail. If the unit price and the total amount for any item are not in agreement, the unit price alone shall be considered to represent the Bidder’s intention and all totals will be corrected to conform thereto. Attached hereto is cash, a certified check, a cashier's check, or a Bidder's bond in the amount of

_____ Dollars, said amount being not less than ten (10) percent of the amount bid. It is agreed a portion equal to the difference between the low bid and second low bid shall be retained as liquidated damages by the City if the undersigned fails or refuses to execute the Contract and furnish the required bonds and certificates of insurance within the time provided.

Contractor Signature: _____

PW Registration #: _____

State License #: _____

Contractor Company Name: _____

C. BID BOND

KNOW ALL MEN BY THESE PRESENTS:

WHEREAS, _____, (hereinafter referred to as "Contractor") intends to submit a bid to the City of Hermosa Beach, California, a Municipal Corporation, for the performance of certain work as required in the City of Hermosa Beach and said work being: **CIP No. 689 CLARK BUILDING RENOVATIONS** as shown in this specification, and in compliance with the specifications therefore under an invitation of said City contained in a notice or advertisement for bids or proposals.

NOW, THEREFORE, we, the Contractor, as Principal, and _____ a corporation organized and existing under the laws of the State of _____, duly authorized to transact business under the laws of the State of California as Surety, are held and firmly bound unto the City of Hermosa Beach, as Obligee, in the sum of _____ Dollars (\$ _____) lawful money of the United States of America, said sum being not less than ten percent (10%) of the bid amount for the payment of which sum well and truly to be made, the said Principal, and said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH THAT: If the bid of the said Principal is rejected by the said Obligee; or if the said Obligee shall accept the bid of the said Principal and said Principal shall enter into an Agreement with said Obligee in accordance with the terms of the bid, and shall give such bond or bonds as may be specified in the bidding or Contract Documents with good and sufficient surety for the faithful performance of such Agreement and for the prompt payment of labor and material furnished in the prosecution thereof; or in the event of the failure of said Principal to enter such Agreement and give such bond or bonds, if said Principal shall pay to said Obligee the difference not to exceed the penalty thereof between the amount specified in said bid and such larger amount for which said Obligee may in good faith Contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. In case suit is brought upon this bond, the court shall fix and award and the surety shall pay, in addition to the face amount hereof, costs and reasonable attorney's fees incurred by the City of Hermosa Beach in successfully enforcing said obligation.

IN WITNESS THEREOF, we have hereunto, set our hands and seals this _____ day
of _____, _____.

Principal
By _____
Title _____

Surety

By _____

Title

Notary Acknowledgment

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

STATE OF CALIFORNIA
 COUNTY OF _____

On _____, 20____, before me, _____, Notary Public, personally appeared _____, who proved to me on the basis of satisfactory

evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature of Notary Public _____

OPTIONAL

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of this form to another document.

CAPACITY CLAIMED BY SIGNER

DESCRIPTION OF ATTACHED DOCUMENT

- .. Individual
- .. Corporate Officer

- | | |
|-------------------------|------------|
| Title(s) | |
| .. Partner(s) | .. Limited |
| | .. General |
| .. Attorney-In-Fact | |
| .. Trustee(s) | |
| .. Guardian/Conservator | |
| .. Other: | |

- | | |
|---------------------------|------------------|
| Title or Type of Document | |
| | Number of Pages |
| | Date of Document |

Signer is representing:
 Name Of Person(s) Or Entity(ies)

 Signer(s) Other Than Named Above

D. BIDDER'S ASSURANCE

CIP No. 689 CLARK BUILDING RENOVATIONS

FROM:

Name of Bidder: _____

Business Address: _____

Telephone No: _____

TO:

Members of the City Council
c/o City Hall
City of Hermosa Beach, California

Members of the City Council:

Pursuant to your published Notice Inviting Bids for: **CIP No. 689 CLARK BUILDING RENOVATIONS**

The undersigned declares that he/she has carefully examined the location of the proposed work; that he/she has carefully examined the Plans and Specifications, and read the accompanying Instructions to Bidders and hereby proposes to furnish all materials, machinery, tools, labor, and services and do all the work necessary to complete the project in accordance with said Plans and Specifications and other Contract Documents at the item prices on the bidding schedule.

BY: _____ TITLE: _____

E. BIDDER'S DECLARATION

CIP No. 689 CLARK BUILDING RENOVATIONS

It is understood and agreed that:

1. The undersigned has carefully examined all documents which will form a part of the Contract; namely, the Notice Inviting Bids, the Instructions to Bidders, this Proposal, the Bid Bond, the Contract, the Faithful Performance Bond, Warranty Bond, the Payment Bond, the federal requirements, if any, the Plans and Specifications, the Special Provisions, and the Technical Provisions.

2. The undersigned has, by investigation at the site of the work and otherwise, satisfied himself as to the nature and location of the work and fully informed himself as to all conditions and matters, which can in any way affect the work or the cost thereof.

3. The undersigned fully understands the scope of work and has checked carefully all words and figures inserted in this Proposal and he further understands that the City will not be responsible for any errors or omissions in the preparation of the Proposal.

4. The undersigned agrees and acknowledges that he is aware of the provisions of Section 3700 of the Labor Code which requires every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that Code, and that the undersigned will comply with such provisions before commencing the performance of the Contract if it is awarded to the undersigned.

The undersigned will execute the Contract and furnish the required statutory bonds and certificates of insurance within the period of time specified in the Contract Documents.

The undersigned will begin work after award of Contract and a Notice to Proceed has been given as herein specified and will complete said work within the time specified in the Bidding Schedule.

5. The undersigned certifies that this Proposal is genuine and not sham or collusive, or made in the interest or on behalf of a person not herein named, and the undersigned has not directly or indirectly induced or solicited any other Bidder to put in a sham bid nor induced any other person, firm, or corporation to refrain from bidding.

6. The undersigned will accept an award and enter into a Contract for all work scheduled herein on which he puts in a bid. The awards for such work are to be entirely at the discretion of the Owner after evaluation of the bids as submitted. The undersigned agrees that the Owner shall recover or retain as liquidated damages an amount equal to the difference between the low bid and amount of the bid of the Bidder with whom the City enters into a Contract, and the surplus, if any, shall be returned to the lowest Bidder in accordance with the provisions of the Public Contract Code section 20174 in the event of his failure to execute a Contract and furnish required bonds and insurance therefor within the time provided.

7. This bid will not be withdrawn within a period of ninety (90) days after the date of its proper opening by the City.

8. The undersigned Bidder stated under penalty of perjury that the representations made in submitting this bid are, to the best of his/her knowledge, true, accurate, and complete.

Respectfully submitted,

Contractor's Business Name	Contractor Signature Title
Business Address: Street	By Title
City State Zip Classification	Contractor's License No. and
Business Phone Number	Date
Name Title	Residence: Street
City State Zip	Residence Phone Number

Note: If the bid is made by an individual, it must be signed with the full name of the Bidder, whose address must be given: if it is made by a firm, it must be signed in the co-partnership's name by a general partner thereof, who shall also sign his or her own name, and the name and full address of each member must be given; and if it is made by a corporation, it must be signed by a properly authorized officer, the corporate name shall be set forth, and the corporate seal shall be affixed.

F. CERTIFICATE OF NON-DISCRIMINATION BY CONTRACTORS

CIP No. 689 CLARK BUILDING RENOVATIONS

As suppliers of goods or services to the City, the firm listed below certifies that it does not discriminate in its employment with regard to race, color, religion, sex, or national origin; that it is in compliance with all applicable federal, state, and local directives, and executive orders regarding non-discrimination in employment; and that it agrees to pursue positively and aggressively the principle of equal opportunity in employment.

We agree specifically:

1. To establish or observe employment policies which affirmatively promote opportunities for minority persons at all job levels.
2. To communicate this policy to all persons concerned, including all company employees, outside recruiting services, especially those serving minority communities, and to the minority communities at large.
3. To take affirmative steps to hire minority employees within the company.

FIRM _____

TITLE OF PERSON SIGNING _____

SIGNATURE _____

DATE _____

Please include any additional information available regarding equal opportunity employment programs now in effect within your company:

G. CERTIFICATION OF PRINCIPAL

CIP No. 689 CLARK BUILDING RENOVATIONS

I am aware of the provisions of Section 3700 of the Labor Code which require every employer to be insured against liability for Workers' Compensation or to undertake self-insurance in accordance with the provisions of that Code, and I will comply with such provisions before commencing the performance of the work of this Contract. (Section 1861, Labor Code.)

Signature: _____

Name: _____

Title: _____

Name of Company: _____

H. DECLARATION OF ELIGIBILITY TO CONTRACT
[Labor Code Section 1777.1; Public Contract Code Section 6109]

CIP No. 689 CLARK BUILDING RENOVATIONS

The undersigned, a duly authorized representative of the Contractor, certifies and declares that:

1. The undersigned Contractor is aware of Section 1771.1 and 1777.7 of the California Labor Code, which prohibit a Contractor or subcontractor who has been found by the Labor Commissioner or the Director of Industrial Relations to be in violation of certain provisions of the Labor Code, from bidding on, being awarded, or performing work as a subcontractor on a public works project for specified periods of time.

2. The undersigned Contractor is not ineligible to bid on, be awarded or perform work as a subcontractor on a public works project by virtue of the foregoing provisions of Sections 1771.1 or 1777.7 of the California Labor Code or any other provision of law.

3. The undersigned Contractor is aware of California Public Contract Code Section 6109, which states:

“(a) A public entity, as defined in Section 1100 [of the Public Contract Code], may not permit a Contractor or subcontractor who is ineligible to bid or work on, or be awarded, a public works project pursuant to Section 1777.1 or 1777.7 of the Labor Code to bid on, be awarded, or perform work as a subcontractor on, a public works project. Every public works project shall contain a provision prohibiting a Contractor from performing work on a public works project with a subcontractor who is ineligible to perform work on the public works project pursuant to Section 1771.1 or 1777.7 of the Labor Code.”

“(b) Any Contract on a public works project entered into between a Contractor and a debarred subcontractor is void as a matter of law. A debarred subcontractor may not receive any public money for performing work as a subcontractor on a public works Contract, and any public money that may have been paid to a debarred subcontractor by a Contractor on the project shall be returned to the awarding body. The Contractor shall be responsible for the payment of wages to workers of a debarred subcontractor who has been allowed to work on the project.”

4. The undersigned Contractor has investigated the eligibility of each and every subcontractor the undersigned Contractor intends to use on this public works project, and determined that none of them is ineligible to perform work as a subcontractor on a public works project by virtue of the foregoing provisions of the Public Contract Code, Sections 1771.1 or 1777.7 of the Labor Code, or any other provision of law.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct. Executed this _____ day of _____, at _____ (place of execution), California.

Signature: _____

Name: _____

Title: _____

Name of Company: _____

I. NON-COLLUSION DECLARATION

CIP No. 689 CLARK BUILDING RENOVATIONS

The undersigned declares:

I am the _____ of _____, the party making the foregoing Bid.

The Bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation. The Bid is genuine and not collusive or sham. The Bidder has not directly or indirectly induced or solicited any other Bidder to put in a false or sham bid. The Bidder has not directly or indirectly colluded, conspired, connived, or agreed with any Bidder or anyone else to put in a sham bid, or to refrain from bidding. The Bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the Bid Price of the 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. All statements contained in the Bid are true. The Bidder has not, directly or indirectly, submitted his or her Bid Price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, to any corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid, and has not paid, and will not pay, any person or entity for such purpose.

Any person executing this declaration on behalf of a Bidder that is a corporation, partnership, joint venture, limited liability company, limited liability partnership, or any other entity, hereby represents that he or she has full power to execute, and does execute, this declaration on behalf of the Bidder.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct and that this declaration is executed on _____ [date], at _____ [city], _____ [state].

NAME OF BIDDER

SIGNATURE OF BIDDER

ADDRESS OF BIDDER

CITY STATE ZIP

J. REFERENCES OF WORK

CIP No. 689 CLARK BUILDING RENOVATIONS

Provide names, addresses, phone numbers and email addresses for at least three public agencies for which Bidder has performed similar work within the past five years.

All contact information must be current.

1. _____

Name and Address of Public Agency

Name and Telephone Number of Public Agency's Project Manager

Name and Detailed Description of Project

Original Contract Amount

Original Date of Completion

Final Contract Amount

Final Date of Completion

Number of Change Orders _____

2. _____

Name and Address of Public Agency

Name and Telephone Number of Public Agency's Project Manager

Name and Detailed Description of Project

Original Contract Amount

Original Date of Completion

Final Contract Amount

Final Date of Completion

Number of Change Orders _____

3. _____

Name and Address of Public Agency

Name and Telephone Number of Public Agency's Project Manager

Name and Detailed Description of Project

Original Contract Amount

Original Date of Completion

Final Contract Amount

Final Date of Completion

Number of Change Orders _____

For additional References, please add separate sheets.

NAME OF BIDDER

SIGNATURE OF BIDDER

DATE _____

K. SUBCONTRACTORS LIST

CIP No. 689 CLARK BUILDING RENOVATIONS

In compliance with the "Subletting and Subcontracting Fair Practices Act" being Sections 4100-4113 of the Government Code of the State of California, and any amendments thereto, each Bidder shall set forth below: (a) the name and location of the place of business, (b) the California Contractor license number, (c) the DIR public works Contractor registration number unless exempt pursuant to Labor Code Sections 1725.5 and 1771.1, and (d) the portion of the work which will be done by each subcontractor who will perform work or labor or render service to the prime Contractor in or about the construction of the work or improvement in an amount in excess of one-half (1/2) of one percent (1%) of the prime Contractor's total bid, and shall further set forth the portion of the work which will be done by each subcontractor. Only one subcontractor for each such portion shall be listed.

Notwithstanding the foregoing, if the work involves the construction of streets and highways, then the Bidder shall list each subcontractor who will perform work or labor or render service to the Bidder in or about the work in an amount in excess of one-half of one percent (0.5%) of the Bidder's Total Bid Price or \$10,000, whichever is greater. No additional time shall be granted to provide the below requested information.

If the Contractor fails to specify a subcontractor for any portion of the work to be performed under the Contract, he shall be deemed to have agreed to perform such portion himself, and he shall not be permitted to subcontract that portion of the work except under the conditions hereinafter set forth.

Subletting or subcontracting of any portion of the work to which subcontractor was designated in the original bid shall only be permitted in cases of public emergency or necessity, and then only after a finding reduced to writing as a public record of the legislative body of the Owner.

We propose to use the following listed subcontractors as per Public Contract Code Section 4100 et seq.: List all Subcontractors. The subcontractor shall be licensed for the type of work they are performing.

Sub-Contractors Name:	Address:
Description of Work:	
CSLB Contractor License No.	DIR Registration No.
Phone No.	Dollar Amount of Work & % of Work

Sub-Contractors Name:	Address:
Description of Work:	
CSLB Contractor License No.	DIR Registration No.
Phone No.	Dollar Amount of Work & % of Work

Sub-Contractors Name:	Address:
Description of Work:	
CSLB Contractor License No.	DIR Registration No.
Phone No.	Dollar Amount of Work & % of Work

Sub-Contractors Name:	Address:
Description of Work:	
CSLB Contractor License No.	DIR Registration No.
Phone No.	Dollar Amount of Work & % of Work

Sub-Contractors Name:	Address:
Description of Work:	
CSLB Contractor License No.	DIR Registration No.
Phone No.	Dollar Amount of Work & % of Work

Percent of work to be performed by sub-Contractors: _____%
(Note: 50% of work is required to be performed by general Contractor)
For additional Sub-Contractors, please add additional sheet(s)

L. IRAN CONTRACTING ACT CERTIFICATION
(Public Contract Code Section 2200 et seq.)

As required by California Public Contract Code Section 2204, the Contractor certifies subject to penalty for perjury that the option checked below relating to the Contractor's status in regard to the Iran Contracting Act of 2010 (Public Contract Code Section 2200 *et seq.*) is true and correct:

The Contractor is not:

(1) identified on the current list of person and entities engaged in investment activities in Iran prepared by the California Department of General Services in accordance with subdivision (b) of Public Contract Code Section 2203; or

(2) a financial instruction that extends, for 45 days or more, credit in the amount of \$20,000,000 or more to any other person or entity identified on the current list of persons and entities engaging in investment activities in Iran prepared by the California Department of General Services in accordance with subdivision (b) of Public Contract Code Section 2203, if that person or entity uses or will use the credit to provide goods or services in the energy sector in Iran.

The City has exempted the Contractor from the requirements of the Iran Contracting Act of 2010 after making a public finding that, absent the exemption, the City will be unable to obtain the goods and/or services to be provided pursuant to the Contract.

The amount of the Contract payable to the Contractor for the Project does not exceed \$1,000,000.

Signature: _____

Printed Name: _____

Title: _____

Firm Name: _____

Date: _____

Note: In accordance with Public Contract Code Section 2205, false certification of this form shall be reported to the California Attorney General and may result in civil penalties equal to the greater of \$250,000 or twice the Contract amount, termination of the Contract and/or ineligibility to bid on Contracts for three years.

M. PUBLIC WORKS CONTRACTOR REGISTRATION CERTIFICATION

Pursuant to Labor Code sections 1725.5 and 1771.1, all Contractors and subcontractors that wish to bid on, be listed in a bid proposal, or enter into a Contract to perform public work must be registered with the Department of Industrial Relations. See <http://www.dir.ca.gov/Public-Works/PublicWorks.html> for additional information.

No bid will be accepted nor any Contract entered into without proof of the Contractor’s and subcontractors’ current registration with the Department of Industrial Relations to perform public work.

Bidder hereby certifies that it is aware of the registration requirements set forth in Labor Code sections 1725.5 and 1771.1 and is currently registered as a Contractor with the Department of Industrial Relations.¹

Name of Bidder: _____

DIR Registration Number: _____

DIR Registration Expiration: _____

Small Project Exemption: _____ Yes or _____ No

Unless Bidder is exempt pursuant to the small project exemption, Bidder further acknowledges:

1. Bidder shall maintain current DIR registration for the duration of the project.
2. Bidder shall maintain a current DIR registration for the duration of the project.
3. Bidder shall include the requirements of Labor Code sections 1725.5 and 1771.1 in its Contract with subcontractors and ensure that all subcontractors are registered at the time of bid opening and maintain registration status for the duration of the project.
4. Failure to submit this form or comply with any of the above requirements may result in a finding that the bid is non-responsive.

Name of Bidder _____

Signature _____

Name and Title _____

Dated _____

¹ If the Project is exempt from the Contractor registration requirements pursuant to the small project exemption under Labor Code Sections 1725.5 and 1771.1, please mark “Yes” in response to “Small Project Exemption.”

V. CONTRACT DOCUMENTS

CIP No. 689 CLARK BUILDING RENOVATIONS

A. CONTRACT AGREEMENT

This Construction Agreement (“Agreement”) is made and entered into as of the date executed by the Mayor and attested to by the City Clerk, by and between [INSERT CONTRACTOR NAME] (hereinafter referred to as "CONTRACTOR") and the City of Hermosa Beach, California, a municipal corporation (hereinafter referred to as "CITY").

R E C I T A L S

- A. Pursuant to the Notice Inviting Sealed Bids for CIP No. 689 CLARK BUILDING RENOVATIONS (“Project”), bids were received, publicly opened, and declared on the date specified in the notice; and
- B. On [INSERT DATE], City’s City Council declared CONTRACTOR to be the lowest responsible Bidder and accepted the bid of CONTRACTOR; and
- C. The City Council has authorized the Mayor to execute a written Contract with CONTRACTOR for furnishing labor, equipment, and material for the CIP No. CIP No. 689 CLARK BUILDING RENOVATIONS in the City of Hermosa Beach.

NOW, THEREFORE, in consideration of the foregoing and the mutual covenants herein contained, it is agreed:

1. GENERAL SCOPE OF WORK: CITY agrees to engage CONTRACTOR and CONTRACTOR agrees to furnish all necessary labor, tools, materials, appliances, and equipment for and do the work for the CIP No. 689 CLARK BUILDING RENOVATIONS in the City of Hermosa Beach. The work shall be performed in accordance with the Plans and Specifications dated [INSERT DATE], (the “Specifications”) on file in the office of the City Clerk and in accordance with bid prices set forth in CONTRACTOR’S Bid Proposal and in accordance with the instructions of the City Engineer.
2. INCORPORATED DOCUMENTS TO BE CONSIDERED COMPLEMENTARY: The Contract documents for the aforesaid project shall consist of the Notice Inviting Bids, Instructions to Bidders, Bid Proposal, Builders General Provisions, Standard Specifications 2021 edition, Special Provisions, Exhibit A and Exhibit B, and all referenced specifications, details, standard drawings, and appendices; together with this Agreement and all required bonds, insurance certificates, permits, notices and affidavits; and also, including any and all addenda or supplemental agreements clarifying, amending, or extending the work contemplated as may be required to insure its completion in an acceptable manner. All of the provisions of said Contract documents are made a part hereof as though fully set forth herein. This Contract is intended to require a complete and finished piece of work and anything necessary to complete the work properly and in accordance with the law and lawful governmental regulations shall be performed by CONTRACTOR whether set out specifically in the Contract or not. Should it be ascertained that any inconsistency exists between the aforesaid documents and this written agreement, the provisions of this Agreement, the Builders General Provisions and the Standard Specifications, in that order, shall control. Collectively, these Contract documents constitute the complete

agreement between CITY and CONTRACTOR and supersede any previous agreements or understandings.

3. COMPENSATION: CONTRACTOR agrees to receive and accept the prices set forth in its Bid Proposal [INSERT VALUE] as full compensation for furnishing all materials, performing all work, and fulfilling all obligations hereunder. Said compensation shall cover all expenses, losses, damages, and consequences arising out of the nature of the work during its progress or prior to its acceptance including those for well and faithfully completing the work and the whole thereof in the manner and time specified in the aforesaid Contract documents; and also including those arising from actions of the elements, unforeseen difficulties or obstructions encountered in the prosecution of the work, suspension or discontinuance of the work, and all other unknowns or risks of any description connected with the work.
4. TIME OF PERFORMANCE: CONTRACTOR agrees to complete the work within [INSERT VALUE] working days from the date of the notice to proceed. By signing this Agreement, CONTRACTOR represents to CITY that the Contract time is reasonable for completion of the work and that CONTRACTOR will complete such work within the Contract time.
5. LIQUIDATED DAMAGES: In accordance with Government Code section 53069.85, it is agreed that CONTRACTOR will pay to CITY the sum set forth in Exhibit "A" for each and every calendar day of delay beyond the time prescribed in the Contract Documents for finishing the Work, as Liquidated Damages and not as a penalty or forfeiture. In the event this is not paid, CONTRACTOR agrees CITY may deduct that amount from any money due or that may become due CONTRACTOR under the Contract. This Article does not exclude recovery of other damages specified in the Contract Documents.
6. SUBSTITUTION OF SECURITIES: Pursuant to section 22300 of the Public Contract Code of the State of California, CONTRACTOR may request CITY to make retention payments directly to an escrow agent or may substitute securities for any money withheld by CITY to ensure performance under the Contract. At the request and expense of CONTRACTOR, securities equivalent to the amount withheld shall be deposited with CITY or with a state or federally chartered bank as the escrow agent who shall return such securities to CONTRACTOR upon satisfactory completion of the Contract. Deposit of securities with an escrow agent shall be subject to a written agreement substantially in the form provided in section 22300 of the Public Contract Code.
7. PREVAILING WAGES AND CALIFORNIA LABOR LAWS.

Pursuant to Labor Code §§ 1720 *et seq.*, and as specified in 8 California Code of Regulations § 16000 ("Prevailing Wage Laws"), CONTRACTOR must pay its workers prevailing wages. It is CONTRACTOR's responsibility to interpret and implement any prevailing wage requirements, and CONTRACTOR agrees to pay any penalty or civil damages resulting from a violation of the prevailing wage laws. CONTRACTOR shall defend, indemnify and hold the CITY, its officials, officers, employees and agents free and harmless from any claim or liability arising out of any failure or alleged failure to comply with the Prevailing Wage Laws. CONTRACTOR and any

subcontractor shall forfeit a penalty of up to \$200 per calendar day or portion thereof for each worker paid less than the prevailing wage rates.

In accordance with Labor Code § 1773.2, copies of the prevailing rate of per diem wages are available upon request from CITY's Engineering Division or the website for State of California Prevailing wage determination at <http://www.dir.ca.gov/DLSR/PWD>. CONTRACTOR must post a copy of the prevailing rate of per diem wages at the job site.

CITY directs CONTRACTOR's attention to Labor Code §§ 1777.5, 1777.6 and 3098 concerning the employment of apprentices by CONTRACTOR or any subcontractor.

Labor Code § 1777.5 requires CONTRACTOR or subcontractor employing tradesmen in any apprenticeship occupation to apply to the joint apprenticeship committee nearest the site of the public works project and which administers the apprenticeship program in that trade for a certificate of approval. The certificate must also fix the ratio of apprentices to journeymen that will be used in the performance of the Contract. The ratio of apprentices to journeymen in such cases will not be less than one to five except:

When employment in the area of coverage by the joint apprenticeship committee has exceeded an average of 15 percent in the 90 days before the request for certificate, or

When the number of apprentices in training in the area exceeds a ratio of one to five, or

When the 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

Assignment of an apprentice to any work performed under a public works Contract would create a condition that would jeopardize his or her life or the life, safety, or property of fellow employees or the public at large, or the specific task to which the apprentice is to be assigned is of a nature that training cannot be provided by a journeyman.

When CONTRACTOR provides evidence that CONTRACTOR employs registered apprentices on all of his Contracts on an annual average of not less than one apprentice to eight journeymen.

CONTRACTOR is required to make contributions to funds established for the administration of apprenticeship programs if CONTRACTOR employs registered apprentices or journeymen in any apprenticeable trade on such Contracts and if other Contractors on the public works site are making such contributions.

CONTRACTOR and any subcontractor must comply with Labor Code §§ 1777.5 and 1777.6 in the employment of apprentices.

Information relative to apprenticeship standards, wage schedules and other requirements may be obtained from the Director of Industrial Relations, ex-officio the Administrator of Apprenticeship, San Francisco, California, or from the Division of Apprenticeship Standards and its branch offices.

The CONTRACTOR or any subcontractor that is determined by the Labor Commissioner to have knowingly violated Section 1777.5 shall forfeit as a civil penalty an amount not exceeding \$100 for each full calendar day of noncompliance, or such greater amount as provided by law.

CONTRACTOR and each subcontractor shall keep an accurate payroll record, showing the name, address, social security number, work classification, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed by him or her in connection with the public work. The payroll records shall be certified and shall be available for inspection at all reasonable hours at the principal office of CONTRACTOR in the manner provided in Labor Code section 1776. In the event of noncompliance with the requirements of this section, CONTRACTOR shall have 10 days in which to comply subsequent to receipt of written notice specifying in what respects such CONTRACTOR must comply with this section. Should noncompliance still be evident after such 10-day period, CONTRACTOR shall, as a penalty to CITY, forfeit not more than \$100.00 for each calendar day or portion thereof, for each worker, until strict compliance is effectuated. The amount of the forfeiture is to be determined by the Labor Commissioner. A Contractor who is found to have violated the provisions of law regarding wages on Public Works with the intent to defraud shall be ineligible to bid on Public Works Contracts for a period of one to three years as determined by the Labor Commissioner. Upon the request of the Division of Apprenticeship Standards or the Division of Labor Standards Enforcement, such penalties shall be withheld from progress payments then due. The responsibility for compliance with this section is on CONTRACTOR. The requirement to submit certified payroll records directly to the Labor Commissioner under Labor Code section 1771.4 shall not apply to work performed on a public works project that is exempt pursuant to the small project exemption specified in Labor Code Section 1771.4.

Any ineligible Contractor or subcontractor pursuant to Labor Code Sections 1777.1 and 1777.7 may not perform work on this Project.

By executing this Contract, CONTRACTOR verifies that it fully complies with all requirements and restrictions of state and federal law respecting the employment of undocumented aliens, including, but not limited to, the Immigration Reform and Control Act of 1986, as may be amended from time to time, and shall require all subcontractors and sub-subcontractors to comply with the same.

8. LEGAL HOURS OF WORK: Eight (8) hours of labor shall constitute a legal day's work for all workmen employed in the execution of this Contract, and CONTRACTOR and any subcontractor under it shall comply with and be governed by the laws of the State of California having to do with working hours set forth in Division 2, Part 7, Chapter 1, Article 3 of the Labor Code of the State of California as amended.

CONTRACTOR shall forfeit, as a penalty to City, twenty-five dollars (\$25.00) for each laborer, workman or mechanic employed in the execution of the Contract, by him or any subcontractor under it, upon any of the work hereinbefore mentioned, for each calendar day during which the

laborer, worker or mechanic is required or permitted to labor more than eight (8) hours in any one calendar day or 40 hours in any one calendar week in violation of the Labor Code.

9. PUBLIC WORKS CONTRACTOR REGISTRATION: Pursuant to Labor Code sections 1725.5 and 1771.1, all Contractors and subcontractors that wish to bid on, be listed in a bid proposal, or enter into a Contract to perform public work must be registered with the Department of Industrial Relations (DIR). No bid will be accepted nor any Contract entered into without proof of the Contractor's and subcontractors' current registration with the DIR to perform public work. Notwithstanding the foregoing, the Contractor registration requirements mandated by Labor Code Sections 1725.5 and 1771.1 shall not apply to work performed on a public works project that is exempt pursuant to the small project exemption specified in Labor Code Sections 1725.5 and 1771.1.
10. LABOR COMPLIANCE AND STOP ORDERS: This Project is subject to compliance monitoring and enforcement by the DIR. It shall be CONTRACTOR's sole responsibility to evaluate and pay the cost of complying with all labor compliance requirements under this Contract and applicable law. Any stop orders issued by the DIR against CONTRACTOR or any subcontractor that affect CONTRACTOR's performance of Work, including any delay, shall be CONTRACTOR's sole responsibility. Any delay arising out of or resulting from such stop orders shall be considered CONTRACTOR caused delay subject to any applicable liquidated damages and shall not be compensable by the CITY. CONTRACTOR shall defend, indemnify and hold CITY, its officials, officers, employees and agents free and harmless from any claim or liability arising out of stop orders issued by the DIR against CONTRACTOR or any subcontractor.
11. DEBARMENT OF CONTRACTORS AND SUBCONTRACTORS: Contractors or subcontractors may not perform work on a public works project with a subcontractor who is ineligible to perform work on a public project pursuant to Labor Code section 1777.1 or 1777.7. Any Contract on a public works project entered into between a Contractor and a debarred subcontractor is void as a matter of law. A debarred subcontractor may not receive any public money for performing work as a subcontractor on a public works Contract. Any public money that is paid, or may have been paid to a debarred subcontractor by a Contractor on the Project shall be returned to the CITY. CONTRACTOR shall be responsible for the payment of wages to workers of a debarred subcontractor who has been allowed to work on the project.
12. LABOR/EMPLOYMENT SAFETY: CONTRACTOR shall comply with all applicable laws and regulations of the federal, state, and local government, including Cal/OSHA requirements and requirements for verification of employees' legal right to work in the United States

CONTRACTOR shall maintain emergency first aid treatment for its employees which complies with the Federal Occupational Safety and Health Act of 1970 (29 U.S.C. § 651 *et seq.*), and California Code of Regulations, Title 8, Industrial Relations Division 1, Department of Industrial Relations, Chapter 4. CONTRACTOR shall ensure the availability of emergency medical services for its employees in accordance with California Code of Regulations, Title 8, Section 1512.

CONTRACTOR shall submit the Illness and Injury Prevention Program and a Project site specific safety program to CITY prior to beginning Work at the Project site. CONTRACTOR shall maintain a confined space program that meets or exceeds the CITY Standards. CONTRACTOR shall adhere to CITY's lock out tag out program

13. TRAVEL AND SUBSISTENCE PAY: CONTRACTOR agrees to pay travel and subsistence pay to each worker needed to execute the work required by this Agreement as such travel and subsistence payments are defined in the applicable collective bargaining agreements filed in accordance with Labor Code Section 1773.8.
14. CONTRACTOR'S LIABILITY: The City of Hermosa Beach and its officers, agents and employees ("Indemnitees") shall not be answerable or accountable in any manner for any loss or damage that may happen to the work or any part thereof, or for any of the materials or other things used or employed in performing the work; or for injury or damage to any person or persons, either workers or employees of CONTRACTOR, of its subcontractors or the public, or for damage to adjoining or other property from any cause whatsoever arising out of or in connection with the performance of the work. CONTRACTOR shall be responsible for any damage or injury to any person or property resulting from defects or obstructions or from any cause whatsoever.

To the fullest extent permitted by law, CONTRACTOR will indemnify Indemnitees against and will hold and save Indemnitees harmless from any and all actions, claims, damages to persons or property, penalties, obligations or liabilities that may be asserted or claimed by any person, firm, entity, corporation, political subdivision, or other organization arising out of or in connection with the work, operation, or activities of CONTRACTOR, its agents, employees, subcontractors or invitees provided for herein, whether or not there is concurrent passive negligence on the part of City. In connection therewith:

a. CONTRACTOR will defend any action or actions filed in connection with any such claims, damages, penalties, obligations or liabilities and will pay all costs and expenses, including attorneys' fees, expert fees and costs incurred in connection therewith.

b. CONTRACTOR will promptly pay any judgment rendered against CONTRACTOR or Indemnitees covering such claims, damages, penalties, obligations and liabilities arising out of or in connection with such work, operations or activities of CONTRACTOR hereunder, and CONTRACTOR agrees to save and hold the Indemnitees harmless therefrom.

c. In the event Indemnitees are made a party to any action or proceeding filed or prosecuted against CONTRACTOR for damages or other claims arising out of or in connection with the work, operation or activities hereunder, CONTRACTOR agrees to pay to Indemnitees and any all costs and expenses incurred by Indemnitees in such action or proceeding together with reasonable attorneys' fees.

Contractor's obligations under this section apply regardless of whether or not such claim, charge, damage, demand, action, proceeding, loss, stop notice, cost, expense, judgment, civil fine

or penalty, or liability was caused in part or contributed to by an Indemnitee. However, without affecting the rights of City under any provision of this agreement, to the extent required by Civil Code section 2782, Contractor shall not be required to indemnify and hold harmless City for liability attributable to the active negligence of City, provided such active negligence is determined by agreement between the parties or by the findings of a court of competent jurisdiction. In instances where City is shown to have been actively negligent and where City active negligence accounts for only a percentage of the liability involved, the obligation of Contractor will be for that entire portion or percentage of liability not attributable to the active negligence of City.

So much of the money due to CONTRACTOR under and by virtue of the Contract as shall be considered necessary by City may be retained by City until disposition has been made of such actions or claims for damages as aforesaid.

It is expressly understood and agreed that the foregoing provisions are intended to be as broad and inclusive as is permitted by the law of the State of California. This indemnity provision shall survive the termination of the Agreement and is in addition to any other rights or remedies which Indemnitees may have under the law.

This indemnity is effective without reference to the existence or applicability of any insurance coverage which may have been required under this Agreement or any additional insured endorsements which may extend to Indemnitees.

CONTRACTOR, on behalf of itself and all parties claiming under or through it, hereby waives all rights of subrogation and contribution against the Indemnitees, while acting within the scope of their duties, from all claims, losses and liabilities arising out of or incident to activities or operations performed by or on behalf of the CONTRACTOR regardless of any prior, concurrent, or subsequent passive negligence by the Indemnitees.

15. THIRD PARTY CLAIMS. In accordance with Public Contract Code § 9201, CITY will promptly inform CONTRACTOR regarding third-party claims against CONTRACTOR, but in no event later than ten (10) business days after CITY receives such claims. Such notification will be in writing and forwarded in accordance with the "Notice" section of this Agreement. As more specifically detailed in the Contract documents, CONTRACTOR agrees to indemnify and defend the City against any third-party claim.
16. WORKERS COMPENSATION: In accordance with California Labor Code Sections 1860 and 3700, CONTRACTOR and each of its subcontractors will be required to secure the payment of compensation to its employees. In accordance with the provisions of California Labor Code Section 1861, CONTRACTOR, by signing this Contract, certifies as follows: "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.

17. INSURANCE: CONTRACTOR shall procure and maintain for the duration of the Agreement, and for 1 year thereafter, insurance against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder by the CONTRACTOR, its agents, representatives, employees, or subcontractors.
- a. Minimum Scope and Limit of Insurance. Coverage shall be at least as broad as:
 - i. Commercial General Liability (CGL): Insurance Services Office (ISO) Form CG 00 01 covering CGL on an “occurrence” basis, including products and completed operations, property damage, bodily injury and personal & advertising injury with limits no less than \$5,000,000 per occurrence. If a general aggregate limit applies, either the general aggregate limit shall apply separately to this project/location (ISO CG 25 03 or 25 04) or the general aggregate limit shall be twice the required occurrence limit.
 - ii. Automobile Liability: Insurance Services Office Form CA 0001 covering Code 1 (any auto), with limits no less than \$5,000,000 per accident for bodily injury and property damage.
 - iii. Workers’ Compensation insurance as required by the State of California, with Statutory Limits, and Employers’ Liability insurance with a limit of no less than \$1,000,000 per accident for bodily injury or disease.
 - iv. Builder’s Risk (Course of Construction) insurance utilizing an “All Risk” (Special Perils) coverage form, with limits equal to the completed value of the project and no coinsurance penalty provisions.
 - v. Professional Liability (if Design/Build), with limits no less than \$2,000,000 per occurrence or claim, and \$2,000,000 policy aggregate.
 - vi. Contractors’ Pollution Legal Liability and/or Asbestos Legal Liability and/or Errors and Omissions (if project involves environmental hazards) with limits no less than \$1,000,000 per occurrence or claim, and \$2,000,000 policy aggregate.
 - vii. If the Contractor maintains broader coverage and/or higher limits than the minimums shown above, the CITY requires and shall be entitled to the broader coverage and/or the higher limits maintained by CONTRACTOR. Any available insurance proceeds in excess of the specified minimum limits of insurance and coverage shall be available to the CITY.
 - b. Self-Insured Retentions. Self-insured retentions must be declared to and approved by the CITY. At the option of the CITY, either: the CONTRACTOR shall obtain coverage to reduce or eliminate such self-insured retentions as respects the CITY, its officers, officials, employees, and volunteers; or the CONTRACTOR shall provide a financial guarantee satisfactory to the CITY guaranteeing payment of losses and related investigations, claim administration, and defense expenses. The policy language shall provide, or be endorsed to provide, that the self-insured retention may be satisfied by either the named insured or CITY.
 - c. Other Insurance Provisions. The insurance policies are to contain, or be endorsed to contain, the following provisions:

- i. The CITY, its officers, officials, employees, and volunteers are to be covered as additional insureds on the CGL policy with respect to liability arising out of work or operations performed by or on behalf of the CONTRACTOR including materials, parts, or equipment furnished in connection with such work or operations and automobiles owned, leased, hired, or borrowed by or on behalf of the CONTRACTOR. General liability coverage can be provided in the form of an endorsement to the CONTRACTOR's insurance (at least as broad as ISO Form CG 20 10, CG 11 85 or both CG 20 10, CG 20 26, CG 20 33, or CG 20 38; and CG 20 37 forms if later revisions used).
- ii. For any claims related to this project, the CONTRACTOR's insurance coverage shall be primary insurance coverage at least as broad as ISO CG 20 01 04 13 as respects the CITY, its officers, officials, employees, and volunteers. Any insurance or self-insurance maintained by the CITY, its officers, officials, employees, or volunteers shall be excess of the CONTRACTOR's insurance and shall not contribute with it.
- iii. Each insurance policy required by this clause shall provide that coverage shall not be canceled, except with notice to the CITY.
- d. Builder's Risk (Course of Construction) Insurance.
 - i. CONTRACTOR may submit evidence of Builder's Risk insurance in the form of Course of Construction coverage. Such coverage shall name the CITY as a loss payee as their interest may appear.
 - ii. If the Project does not involve new or major reconstruction, at the option of the CITY, an Installation Floater may be acceptable. For such projects, a Property Installation Floater shall be obtained that provides for the improvement, remodel, modification, alteration, conversion or adjustment to existing buildings, structures, processes, machinery, and equipment. The Property Installation Floater shall provide property damage coverage for any building, structure, machinery or equipment damaged, impaired, broken, or destroyed during the performance of the Work, including during transit, installation, and testing at the CITY's site.
- e. Claims Made Policies. If any coverage required is written on a claims-made coverage form:
 - i. The retroactive date must be shown, and this date must be before the execution date of the Contract or the beginning of Contract work.
 - ii. Insurance must be maintained and evidence of insurance must be provided for at least five (5) years after completion of Contract work.
 - iii. If coverage is cancelled or non-renewed, and not replaced with another claims-made policy form with a retroactive date prior to the Contract effective, or start of work date, the CONTRACTOR must purchase extended reporting period coverage for a minimum of five (5) years after completion of Contract work.
 - iv. A copy of the claims reporting requirements must be submitted to the CITY for review.

- v. If the services involve lead-based paint or asbestos identification/remediation, the Contractors Pollution Liability policy shall not contain lead-based paint or asbestos exclusions. If the services involve mold identification/remediation, the Contractors Pollution Liability policy shall not contain a mold exclusion, and the definition of Pollution shall include microbial matter, including mold.
 - f. Acceptability of Insurers. Insurance is to be placed with insurers authorized to conduct business in the state with a current A.M. Best rating of no less than A: VII, unless otherwise acceptable to the CITY.
 - g. Waiver of Subrogation. CONTRACTOR hereby agrees to waive rights of subrogation which any insurer of CONTRACTOR may acquire from CONTRACTOR by virtue of the payment of any loss. CONTRACTOR agrees to obtain any endorsement that may be necessary to affect this waiver of subrogation. The Workers' Compensation policy shall be endorsed with a waiver of subrogation in favor of the CITY for all work performed by the CONTRACTOR, its employees, agents and subcontractors.
 - h. Verification of Coverage. CONTRACTOR shall furnish the CITY with original Certificates of Insurance including all required amendatory endorsements (or copies of the applicable policy language effecting coverage required by this clause) and a copy of the Declarations and Endorsement Page of the CGL policy listing all policy endorsements to CITY before work begins. However, failure to obtain the required documents prior to the work beginning shall not waive the CONTRACTOR's obligation to provide them. The CITY reserves the right to require complete, certified copies of all required insurance policies, including endorsements, required by these specifications, at any time.
 - i. Subcontractors. CONTRACTOR shall require and verify that all subcontractors maintain insurance meeting all requirements stated herein, and CONTRACTOR shall ensure that CITY is an additional insured on insurance required from subcontractors. For CGL coverage, subcontractors shall provide coverage with a form at least as broad as CG 20 38 04 13.
 - j. Special Risks or Circumstances. CITY reserves the right to modify these requirements, including limits, based on the nature of the risk, prior experience, insurer, coverage, or other circumstances.
18. ASSIGNMENT: This Contract is not assignable nor the performance of either party's duties delegable without the prior written consent of the other party. Any attempted or purported assignment or delegation of any of the rights or obligations of either party without the prior written consent of the other shall be void and of no force and effect.
19. INDEPENDENT CONTRACTOR: CONTRACTOR is and shall at all times remain as to the CITY, a wholly independent Contractor. Neither the CITY nor any of its agents shall have control of the conduct of CONTRACTOR or any of CONTRACTOR'S employees, except as herein set forth. CONTRACTOR shall not at any time or in any manner represent that it or any of its agents or employees are in any manner agents or employees of CITY.

20. TAXES: CONTRACTOR is responsible for paying all retail sales and use, transportation, export, import, special or other taxes and duties applicable to, and assessable against any work, materials, equipment, services, processes and operations incidental to or involved in this Contract. CONTRACTOR is responsible for ascertaining and arranging to pay them. The prices established in the Contract shall include compensation for any taxes CONTRACTOR is required to pay by laws and regulations in effect at the bid opening date.
21. LICENSES: CONTRACTOR represents and warrants to CITY that it has all licenses, permits, qualifications, insurance, and approvals of whatsoever nature which are legally required of CONTRACTOR to practice its profession. CONTRACTOR represents and warrants to CITY that CONTRACTOR shall, at its sole cost and expense, keep in effect or obtain at all times during the term of this Agreement any licenses, permits, insurance, and approvals which are legally required of CONTRACTOR to practice its profession. CONTRACTOR shall maintain a City of Hermosa Beach business license, if required under CITY ordinance.
- Contractors are required by law to be licensed and regulated by the Contractors' State License Board which has jurisdiction to investigate complaints against Contractors if a complaint regarding a patent act or omission is filed within five (5) years of the date of the alleged violation. A complaint regarding a latent act or omission pertaining to structural defects must be filed within ten (10) years of the date of the alleged violation. Any questions concerning a Contractor may be referred to the Registrar, Contractors' State License Board, P.O. Box 26000, Sacramento, California 95826.
22. RECORDS: CONTRACTOR shall maintain accounts and records, including personnel, property, and financial records, adequate to identify and account for all costs pertaining to this Agreement and such other records as may be deemed necessary by CITY or any authorized representative, and will be retained for four years after the expiration of this Agreement. All such records shall be made available for inspection or audit by CITY at any time during regular business hours.
23. SEVERABILITY. If any portion of these Contract documents are declared by a court of competent jurisdiction to be invalid or unenforceable, then such portion will be deemed modified to the extent necessary in the opinion of the court to render such portion enforceable and, as so modified, such portion and the balance of this Agreement will continue in full force and effect.
24. WHOLE AGREEMENT: This Agreement supersedes any and all other agreements either oral or written, between the parties and contains all of the covenants and agreements between the parties pertaining to the work of improvements described herein. Each party to this Contract acknowledges that no representations, inducements, promises or agreements, orally or otherwise, have been made by any party, or anyone acting on behalf of any party, which are not embodied herein, and that any other agreement, statements or promise not contained in this Contract shall not be valid or binding. Any modifications of this Contract will be effective only if signed by the party to be charged.
25. AUTHORITY: CONTRACTOR affirms that the signatures, titles, and seals set forth hereinafter in execution of this Agreement represent all individuals, firm members, partners, joint ventures, and/or corporate officers having a principal interest herein. Each party warrants that the

individuals who have signed this Agreement have the legal power, right, and authority to make this Agreement and to bind each respective party. This Agreement may be modified by written amendment. CITY's city manager may execute any such amendment on CITY's behalf.

26. NOTICES: All notices permitted or required under this Agreement shall be in writing, and shall be deemed made when delivered to the applicable party's representative as provided in this Agreement. Additionally, such notices may be given to the respective parties at the following addresses, or at such other addresses as the parties may provide in writing for this purpose. Such notices shall be deemed made when personally delivered or when mailed forty-eight (48) hours after deposit in the U.S. mail, first-class postage prepaid, and addressed to the party at its applicable address.

CITY OF HERMOSA BEACH
1315 Valley Drive
Hermosa Beach, CA 90254

Attention: _____ Project Manager

CONTRACTOR:

Attention: _____

27. DISPUTES. Effective January 1, 1991, Section 20104 et seq., of the California Public Contract Code prescribes a process utilizing informal conferences, non-binding judicial supervised mediation, and judicial arbitration to resolve disputes on construction claims of \$375,000 or less. Effective January 1, 2017, Section 9204 of the Public Contract Code prescribes a process for negotiation and mediation to resolve disputes on construction claims. The intent of this Section is to implement Sections 20104 et seq. and Section 9204 of the California Public Contract Code. This Section shall be construed to be consistent with said statutes.

Claims. For purposes of this Section, "Claim" means a separate demand by CONTRACTOR, after a change order duly requested in accordance with the terms of this Contract has been denied by the CITY, for (A) a time extension, (B) payment of money or damages arising from Work done by or on behalf of CONTRACTOR pursuant to the Contract, or (C) an amount the payment of which is disputed by the CITY. A "Claim" does not include any demand for payment for which CONTRACTOR has failed to provide notice, request a change order, or otherwise failed to follow any procedures contained in the Contract Documents. Claims governed by this Section may not be filed unless and until CONTRACTOR completes all procedures for giving notice of delay or change and for the requesting of a time extension or change order, including but not necessarily limited to the change order procedures contained herein, and CONTRACTOR's request for a change has been denied in whole or in part. Claims governed by this Section must be filed no later than fourteen (14) days after a request for change has been denied in whole or in

part or after any other event giving rise to the Claim. The Claim shall be submitted in writing to the CITY and shall include on its first page the following in 16 point capital font: "THIS IS A CLAIM." Furthermore, the claim shall include the documents necessary to substantiate the claim. Nothing in this Section is intended to extend the time limit or supersede notice requirements otherwise provided by Contract for the filing of claims, including all requirements pertaining to compensation or payment for extra Work, disputed Work, and/or changed conditions. Failure to follow such Contractual requirements shall bar any claims or subsequent lawsuits for compensation or payment thereon.

Supporting Documentation. The CONTRACTOR shall submit all claims in the following format:

Summary of claim merit and price, reference Contract Document provisions pursuant to which the claim is made

List of documents relating to claim:

Specifications

Drawings

Clarifications (Requests for Information)

Schedules

Other

Chronology of events and correspondence

Analysis of claim merit

Analysis of claim cost

Time impact analysis in CPM format

If CONTRACTOR's claim is based in whole or in part on an allegation of errors or omissions in the Drawings or Specifications for the Project, CONTRACTOR shall provide a summary of the percentage of the claim subject to design errors or omissions and shall obtain a certificate of merit in support of the claim of design errors and omissions.

Cover letter and certification of validity of the claim, including any claims from subcontractors of any tier, in accordance with Government Code section 12650 *et seq.*

City's Response. Upon receipt of a claim pursuant to this Section, CITY shall conduct a reasonable review of the claim and, within a period not to exceed 45 days, shall provide CONTRACTOR a written statement identifying what portion of the claim is disputed and what portion is undisputed. Any payment due on an undisputed portion of the claim will be processed and made within 60 days after the public entity issues its written statement.

If CITY needs approval from its governing body to provide the CONTRACTOR a written statement identifying the disputed portion and the undisputed portion of the claim, and the governing body does not meet within the 45 days or within the mutually agreed to extension of time following receipt of a claim sent by registered mail or certified mail, return receipt

requested, CITY shall have up to three days following the next duly publicly noticed meeting of the governing body after the 45-day period, or extension, expires to provide CONTRACTOR a written statement identifying the disputed portion and the undisputed portion.

Within 30 days of receipt of a claim, CITY may request in writing additional documentation supporting the claim or relating to defenses or claims CITY may have against the CONTRACTOR. If additional information is thereafter required, it shall be requested and provided pursuant to this subdivision, upon mutual agreement of CITY and the CONTRACTOR.

CITY's written response to the claim, as further documented, shall be submitted to CONTRACTOR within 30 days (if the claim is less than \$50,000, within 15 days) after receipt of the further documentation, or within a period of time no greater than that taken by CONTRACTOR in producing the additional information or requested documentation, whichever is greater.

Meet and Confer. If the CONTRACTOR disputes CITY's written response, or CITY fails to respond within the time prescribed, the CONTRACTOR may so notify CITY, in writing, either within 15 days of receipt of CITY's response or within 15 days of CITY's failure to respond within the time prescribed, respectively, and demand an informal conference to meet and confer for settlement of the issues in dispute. Upon receipt of a demand, CITY shall schedule a meet and confer conference within 30 days for settlement of the dispute.

Mediation. Within 10 business days following the conclusion of the meet and confer conference, if the claim or any portion of the claim remains in dispute, CITY shall provide the CONTRACTOR a written statement identifying the portion of the claim that remains in dispute and the portion that is undisputed. Any payment due on an undisputed portion of the claim shall be processed and made within 60 days after CITY issues its written statement. Any disputed portion of the claim, as identified by CONTRACTOR in writing, shall be submitted to nonbinding mediation, with CITY and CONTRACTOR sharing the associated costs equally. CITY and CONTRACTOR shall mutually agree to a mediator within 10 business days after the disputed portion of the claim has been identified in writing unless the parties agree to select a mediator at a later time.

If the Parties cannot agree upon a mediator, each Party shall select a mediator and those mediators shall select a qualified neutral third party to mediate with regard to the disputed portion of the claim. Each Party shall bear the fees and costs charged by its respective mediator in connection with the selection of the neutral mediator.

For purposes of this section, mediation includes any nonbinding process, including, but not limited to, neutral evaluation or a dispute review board, in which an independent third party or board assists the Parties in dispute resolution through negotiation or by issuance of an evaluation. Any mediation utilized shall conform to the timeframes in this section.

Unless otherwise agreed to by CITY and CONTRACTOR in writing, the mediation conducted pursuant to this section shall excuse any further obligation under Section 20104.4 to mediate after litigation has been commenced.

The mediation shall be held no earlier than the date CONTRACTOR completes the Work or the date that CONTRACTOR last performs Work, whichever is earlier. All unresolved claims shall be considered jointly in a single mediation unless a new unrelated claim arises after mediation is completed.

Procedures After Mediation. If following the mediation, the claim or any portion remains in dispute, CONTRACTOR must file a claim pursuant to 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 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 CONTRACTOR submits his or her written claim pursuant to subdivision (a) until the time the claim is denied, including any period of time utilized by the meet and confer conference or mediation.

Civil Actions. The following procedures are established for all civil actions filed to resolve claims subject to this Section:

Within 60 days, but no earlier than 30 days, following the filing or responsive pleadings, the court shall submit the matter to non-binding mediation unless waived by mutual stipulation of both parties or unless mediation was held prior to commencement of the action in accordance with Public Contract Code section 9204 and the terms of these procedures.. The mediation process shall provide for the selection within 15 days by both parties of a disinterested third person as mediator, shall be commenced within 30 days of the submittal, and shall be concluded within 15 days from the commencement of the mediation unless a time requirement is extended upon a good cause showing to the court.

If the matter remains in dispute, the case shall be submitted to judicial arbitration pursuant to Chapter 2.5 (commencing with Section 1141.10) of Title 3 of Part 3 of the Code of Civil Procedure, notwithstanding Section 1114.11 of that code. The Civil Discovery Act of 1986 (Article 3 (commencing with Section 2016) of Chapter 3 of Title 3 of Part 4 of the Code of Civil Procedure) shall apply to any proceeding brought under this subdivision consistent with the rules pertaining to judicial arbitration.

In addition to Chapter 2.5 (commencing with Section 1141.10) of Title 3 of Part 3 of the Code of Civil Procedure, (A) arbitrators shall, when possible, be experienced in construction law, and (B) any party appealing an arbitration award who does not obtain a more favorable judgment shall, in addition to payment of costs and fees under that chapter, also pay the attorney's fees on appeal of the other party.

Government Code Claims. In addition to any and all Contract requirements pertaining to notices of and requests for compensation or payment for extra work, disputed work, claims and/or changed conditions, CONTRACTOR must comply with the claim procedures set forth in Government Code sections 900 et seq. prior to filing any lawsuit against the CITY. Such Government Code claims and any subsequent lawsuit based upon the Government Code claims shall be limited to those matters that remain unresolved after all procedures pertaining to extra work, disputed work, claims, and/or changed conditions have been followed by CONTRACTOR. If no such Government Code claim is submitted, or if any prerequisite Contractual requirements are not otherwise satisfied as specified herein, CONTRACTOR shall

be barred from bringing and maintaining a valid lawsuit against the CITY. A Government Code claim must be filed no earlier than the date the work is completed or the date CONTRACTOR last performs work on the Project, whichever occurs first. A Government Code claim shall be inclusive of all unresolved claims unless a new unrelated claim arises after the Government Code claim is submitted.

Non-Waiver. CITY's failure to respond to a claim from CONTRACTOR within the time periods described in this Section or to otherwise meet the time requirements of this Section shall result in the claim being deemed rejected in its entirety. CITY's failure to respond shall not waive CITY's rights to any subsequent procedures for the resolution of disputed claims.

24. NON-DISCRIMINATION: Contractor represents that it is an equal opportunity employer and that it shall not discriminate against any employee or applicant for employment because of race, religion, color, national origin, ancestry, sex, age or other interests protected by the State or Federal Constitutions. Such non-discrimination shall include, but not be limited to, all activities related to initial employment, upgrading, demotion, transfer, recruitment or recruitment advertising, layoff or termination. A violation of this section exposes CONTRACTOR to the penalties provided for in Labor Code Section 1735.
25. TERMINATION: This Contract may be terminated by CITY at any time, either with or without cause, by giving CONTRACTOR three (3) days advance written notice. In the event of termination by CITY for any reason other than the fault of CONTRACTOR, CITY shall pay CONTRACTOR for all Work performed up to that time as provided herein. In the event of breach of the Contract by Contractor, CITY may terminate the Contract immediately without notice, may reduce payment to CONTRACTOR in the amount necessary to offset CITY's resulting damages, and may pursue any other available recourse against CONTRACTOR. CONTRACTOR may not terminate this Contract except for cause. In the event this Contract is terminated in whole or in part as provided, CITY may procure, upon such terms and in such manner as it may determine appropriate, services similar to those terminated. Further, if this Contract is terminated as provided, CITY may require CONTRACTOR to provide all finished or unfinished documents, data, diagrams, drawings, materials or other matter prepared or built by CONTRACTOR in connection with its performance of this Contract.
26. ANTI-TRUST CLAIMS: This provision shall be operative if this Contract Agreement is applicable to California Public Contract Code Section 7103.5. In entering into this Contract Agreement to supply goods, services or materials, Contractor hereby offers and agrees to assign to the Agency 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. Section 15) or under the Cartwright Act (Chapter 2, commencing with Section 16700, of Part 2 of Division 7 of the Business and Professions Code) arising from purchases of goods, services, or materials pursuant to the Contract Agreement. This assignment shall be made and become effective at the time the Agency tender final payment to Contractor, without further acknowledgment by the Parties.
27. NO THIRD PARTY BENEFICIARY. This Contract and every provision herein is for the exclusive benefit of the Contractor and the City and not for the benefit of any other party. There will be no incidental or other beneficiaries of any of the Contractor's or the City's obligations under this Contract.

28. TIME IS OF ESSENCE. Time is of the essence for each and every provision of the Contract Documents.
29. FORCE MAJEURE. If CONTRACTOR is delayed in the performance or progress of the work by a Force Majeure Event, then the CONTRACTOR shall be entitled to a time extension, as provided in the Contract documents, when the work stopped is on the critical path and shall not be charged liquidated damages. Such a non-compensable adjustment shall be CONTRACTOR's sole and exclusive remedy for such delays and the CONTRACTOR will not receive an adjustment to the Contract price or any other compensation. Contractor must submit a timely request in accordance with the requirements of the Contract documents. A Force Majeure Event shall mean an event that materially affects a party's performance and is one or more of the following: (1) Acts of God or other natural disasters occurring at the project site; (2) terrorism or other acts of a public enemy; (3) orders of governmental authorities (including, without limitation, unreasonable and unforeseeable delay in the issuance of permits or approvals by governmental authorities that are required for the work); (4) pandemics, epidemics or quarantine restrictions; and (5) strikes and other organized labor action occurring at the project site and the effects thereof on the work, only to the extent such strikes and other organized labor action are beyond the control of CONTRACTOR and its subcontractors, of every tier, and to the extent the effects thereof cannot be avoided by use of replacement workers. For purposes of this section, "orders of governmental authorities," includes ordinances, emergency proclamations and orders, rules to protect the public health, welfare and safety, and other actions of the City in its capacity as a municipal authority.
30. PROVISIONS REQUIRED BY LAW AND CONTRACTOR COMPLIANCE. Each and every provision of law required to be included in these Contract Documents shall be deemed to be included in these Contract Documents. The Contractor shall comply with all requirements of applicable federal, state and local laws, rules and regulations, including, but not limited to, the provisions of the California Labor Code and California Public Contract Code which are applicable to this Work.
31. ACCEPTANCE OF FACSIMILE SIGNATURES. The Parties agree that this Contract, agreements ancillary to this Contract, and related documents to be entered into in connection with this Contract will be considered signed when the signature of a party is delivered by facsimile transmission. Such facsimile signature will be treated in all respects as having the same effect as an original signature.
32. GOVERNING LAW: This Agreement shall be governed by the laws of the State of California, and exclusive venue for any action involving this Contract will be in Los Angeles County.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement with all the formalities required by law on the respective dates set forth opposite their signatures.

State of California
CONTRACTOR'S License No. _____

CONTRACTOR

_____ By: _____
Date TITLE

CITY OF HERMOSA BEACH, CALIFORNIA

_____ By: _____
Date MAYOR

ATTEST:

_____ By: _____
Date CITY CLERK

CONTRACTOR'S Business Phone _____

Emergency Phone at which CONTRACTOR can be reached at any time: () _____

APPROVED AS TO FORM:

CITY ATTORNEY

Date

**B. AGREEMENT OF INDEMNIFICATION
AND HOLD HARMLESS AND WAIVER OF SUBROGATION AND CONTRIBUTION**

CIP No. 689 CLARK BUILDING RENOVATIONS

Contract/Agreement/License/Permit No. or description: _____

Indemnitor(s) (list all names): _____

To the fullest extent permitted by law, Indemnitor hereby agrees, at its sole cost and expense, to defend, protect, indemnify, and hold harmless the City of Hermosa Beach and its respective elected officials, officers, attorneys, agents, employees, volunteers, successors, and assigns (collectively "Indemnitees") from and against any and all damages, costs, expenses, liabilities, claims, demands, causes of action, proceedings, expenses, judgments, penalties, liens, and losses of any nature whatsoever, including fees of accountants, attorneys, or other professionals and all costs associated therewith (collectively "Liabilities"), arising or claimed to arise, directly or indirectly, out of, in connection with, resulting from, or related to any act, failure to act, error, or omission of Indemnitor or any of its officers, agents, servants, employees, subcontractors, materialmen, suppliers or their officers, agents, servants or employees, arising or claimed to arise, directly or indirectly, out of, in connection with, resulting from, or related to the above-referenced Contract, agreement, license, or permit (the "Agreement") or the performance or failure to perform any term, provision, covenant, or condition of the Agreement, including this indemnity provision. This indemnity provision is effective regardless of any prior, concurrent, or subsequent active or passive negligence by Indemnitees and shall operate to fully indemnify Indemnitees against any such negligence. This indemnity provision shall survive the termination of the Agreement and is in addition to any other rights or remedies which Indemnitees may have under the law. Payment is not required as a condition precedent to an Indemnitee's right to recover under this indemnity provision, and an entry of judgment against an Indemnitee shall be conclusive in favor of the Indemnitee's right to recover under this indemnity provision. Indemnitor shall pay Indemnitees for any attorney fees and costs incurred in enforcing this indemnification provision. Notwithstanding the foregoing, nothing in this instrument shall be construed to encompass (a) Indemnitees' sole negligence or willful misconduct to the limited extent that the underlying Agreement is subject to Civil Code 2782(a), or (b) the Contracting public agency's active negligence to the limited extent that the underlying Agreement is subject to Civil Code 2782(b). This indemnity is effective without reference to the existence or applicability of any insurance coverages which may have been required under the Agreement or any additional insured endorsements which may extend to Indemnitees.

Indemnitor, on behalf of itself and all parties claiming under or through it, hereby waives all rights of subrogation and contribution against the Indemnitees, while acting within the scope of their duties, from all claims, losses and liabilities arising out of or incident to activities or operations performed by or on behalf of the Indemnitor regardless of any prior, concurrent, or subsequent active or passive negligence by the Indemnitees. Accountants, attorneys, or other professionals employed by Indemnitor to defend Indemnitees shall be selected by Indemnitees.

In the event there is more than one person or entity named in the Agreement as an Indemnitor, then all obligations, liabilities, covenants and conditions under this instrument shall be joint and several.

"Indemnitor"

Name _____

Name _____

By: _____

By: _____

C. EQUALS

CIP No. 689 CLARK BUILDING RENOVATIONS

The undersigned desires to use the material, product, thing, or service described below, as “an equal” to such item as specified.

In accordance with the provisions under General Conditions, entitled EQUALS, if the City shall find any item so described equal to the respective item specified, then the undersigned may furnish such item, together with all necessary labor, materials, equipment and incidentals required to perform and complete the work.

Contractor’s Name

Date

Address

Telephone Number

Materials, apparatus or equipment specified for which Bidder proposes “an equal”		Complete description of the materials, apparatus or equipment the Bidder desires to use as “an equal” and name of Contractor if different
<i>Specify page number</i>		
1.		
2.		
3.		

D. FAITHFUL PERFORMANCE BOND

CIP No. 689 CLARK BUILDING RENOVATIONS

KNOW ALL PERSONS BY THESE PRESENTS:

THAT WHEREAS, the City of Hermosa Beach, (hereinafter referred to as “City”) has awarded to _____, (hereinafter referred to as the “Contractor”) an agreement for **Contract No.** _____, (hereinafter referred to as the “Project”).

WHEREAS, the work to be performed by the Contractor is more particularly set forth in the Contract Documents for the Project dated _____, (hereinafter referred to as “Contract Documents”), the terms and conditions of which are expressly incorporated herein by reference; and

WHEREAS, the Contractor is required by said Contract Documents to perform the terms thereof and to furnish a bond for the faithful performance of said Contract Documents.

NOW, THEREFORE, we, _____, the undersigned Contractor and _____ as Surety, a corporation organized and duly authorized to transact business under the laws of the State of California, are held and firmly bound unto the City in the sum of _____ DOLLARS, (\$ _____), said sum being not less than one hundred percent (100%) of the total amount of the Contract, for which amount well and truly to be made, we bind ourselves, our heirs, executors and administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that, if the Contractor, his or its heirs, executors, administrators, successors or assigns, shall in all things stand to and abide by, and well and truly keep and perform the covenants, conditions and agreements in the Contract Documents and any alteration thereof made as therein provided, on its part, to be kept and performed at the time and in the manner therein specified, and in all respects according to their intent and meaning; and shall faithfully fulfill all obligations including the one (1) year guarantee of all materials and workmanship; and shall indemnify and save harmless the City, its officials, officers, employees, and authorized volunteers, as stipulated in said Contract Documents, then this obligation shall become null and void; otherwise it shall be and remain in full force and effect.

As a part of the obligation secured hereby and in addition to the face amount specified therefore, there shall be included costs and reasonable expenses and fees including reasonable attorney’s fees, incurred by City in enforcing such obligation.

As a condition precedent to the satisfactory completion of the Contract Documents, unless otherwise provided for in the Contract Documents, the above obligation shall hold good for a period of one (1) year after the acceptance of the work by City, during which time if Contractor shall fail to make full, complete, and satisfactory repair and replacements and totally protect the City from loss or damage resulting from or caused by defective materials or faulty workmanship.

The obligations of Surety hereunder shall continue so long as any obligation of Contractor remains. Nothing herein shall limit the City's rights or the Contractor or Surety's obligations under the Contract, law or equity, including, but not limited to, California Code of Civil Procedure Section 337.15.

Whenever Contractor shall be, and is declared by the City to be, in default under the Contract Documents, the Surety shall remedy the default pursuant to the Contract Documents, or shall promptly, at the City's option:

- i. Take over and complete the Project in accordance with all terms and conditions in the Contract Documents; or
- ii. Obtain a bid or bids for completing the Project in accordance with all terms and conditions in the Contract Documents and upon determination by Surety of the lowest responsive and responsible Bidder, arrange for a Contract between such Bidder, the Surety and the City, and make available as work progresses sufficient funds to pay the cost of completion of the Project, less the balance of the Contract price, including other costs and damages for which Surety may be liable. The term "balance of the Contract price" as used in this paragraph shall mean the total amount payable to Contractor by the City under the Contract and any modification thereto, less any amount previously paid by the City to the Contractor and any other set offs pursuant to the Contract Documents.
- iii. Permit the City to complete the Project in any manner consistent with California law and make available as work progresses sufficient funds to pay the cost of completion of the Project, less the balance of the Contract price, including other costs and damages for which Surety may be liable. The term "balance of the Contract price" as used in this paragraph shall mean the total amount payable to Contractor by the City under the Contract and any modification thereto, less any amount previously paid by the City to the Contractor and any other set offs pursuant to the Contract Documents.

Surety expressly agrees that the City may reject any Contractor or subcontractor which may be proposed by Surety in fulfillment of its obligations in the event of default by the Contractor.

Surety shall not utilize Contractor in completing the Project nor shall Surety accept a bid from Contractor for completion of the Project if the City, when declaring the Contractor in default, notifies Surety of the City's objection to Contractor's further participation in the completion of the Project.

The Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract Documents or to the Project to be performed thereunder shall in any way affect its obligations on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract Documents or to the Project.

By their signatures hereunder, Surety and Contractor hereby confirm under penalty of perjury that surety is an admitted surety insurer authorized to do business in the State of California.

[REMAINDER OF PAGE LEFT INTENTIONALLY BLANK]

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

Contractor/ Principal

By _____

Title _____

Surety

By _____
Attorney-in-Fact

Title _____

The rate of premium on this bond is _____ per thousand. The total amount of premium charges is \$ _____.
(The above must be filled in by corporate attorney.)

THIS IS A REQUIRED FORM

Any claims under this bond may be addressed to:

(Name and Address of Surety) _____

(Name and Address of Agent or Representative for service of process in California, if different from above) _____

(Telephone number of Surety and Agent or Representative for service of process in California) _____

Notary Acknowledgment

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

STATE OF CALIFORNIA
 COUNTY OF _____

On _____, 20___, before me, _____, Notary Public, personally appeared _____, who proved to me on the basis of satisfactory

evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature of Notary Public _____

OPTIONAL

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of this form to another document.

CAPACITY CLAIMED BY SIGNER

DESCRIPTION OF ATTACHED DOCUMENT

- .. Individual
- .. Corporate Officer

 Title(s)
 .. Partner(s) .. Limited
 .. General

 Title or Type of Document

- .. Attorney-In-Fact
- .. Trustee(s)
- .. Guardian/Conservator
- .. Other:

 Number of Pages

Signer is representing:
 Name Of Person(s) Or Entity(ies)

 Date of Document

 Signer(s) Other Than Named Above

NOTE: This acknowledgment is to be completed for Contractor/Principal.

Notary Acknowledgment

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

STATE OF CALIFORNIA
 COUNTY OF _____

On _____, 20___, before me, _____, Notary Public, personally appeared _____, who proved to me on the basis of satisfactory

evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature of Notary Public _____

OPTIONAL

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of this form to another document.

CAPACITY CLAIMED BY SIGNER

DESCRIPTION OF ATTACHED DOCUMENT

- .. Individual
- .. Corporate Officer

- | | |
|-------------------------|------------|
| | Title(s) |
| .. Partner(s) | .. Limited |
| .. Attorney-In-Fact | .. General |
| .. Trustee(s) | |
| .. Guardian/Conservator | |
| .. Other: | |

	Title or Type of Document
	Number of Pages

- .. Attorney-In-Fact
- .. Trustee(s)
- .. Guardian/Conservator
- .. Other:

	Date of Document
--	------------------

Signer is representing:
 Name Of Person(s) Or Entity(ies)

 Signer(s) Other Than Named Above

NOTE: This acknowledgment is to be completed for the Attorney-in-Fact. The Power-of Attorney to local representatives of the bonding company must also be attached.

END OF PERFORMANCE BOND

E. PAYMENT BOND (LABOR AND MATERIALS)

CIP No. 689 CLARK BUILDING RENOVATIONS

KNOW ALL MEN BY THESE PRESENTS That

WHEREAS, the City of Hermosa Beach (hereinafter designated as the "City"), by action taken or a resolution passed _____, 20____, has awarded to _____ hereinafter designated as the "Principal," a Contract for the work described as follows: **Contract No.** _____ (the "Project"); and

WHEREAS, said Principal is required to furnish a bond in connection with said Contract; providing that if said Principal or any of its Subcontractors shall fail to pay for any materials, provisions, provender, equipment, or other supplies used in, upon, for or about the performance of the work Contracted to be done, or for any work or labor done thereon of any kind, or for amounts due under the Unemployment Insurance Code or for any amounts required to be deducted, withheld, and paid over to the Employment Development Department from the wages of employees of said Principal and its Subcontractors with respect to such work or labor the Surety on this bond will pay for the same to the extent hereinafter set forth.

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

THE CONDITION OF THIS OBLIGATION IS SUCH that if said Principal, his or its subcontractors, heirs, executors, administrators, successors or assigns, shall fail to pay any of the persons named in Civil Code Section 9100, fail to pay for any materials, provisions or other supplies, used in, upon, for or about the performance of the work Contracted to be done, or for any work or labor thereon of any kind, or amounts due under the 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 Employment Development Department or Franchise Tax Board from the wages of employees of the Contractor and his subcontractors pursuant to Revenue and Taxation Code Section 18663, with respect to such work and labor the Surety or Sureties will pay for the same, in an amount not exceeding the sum herein above specified, and also, in case suit is brought upon this bond, all litigation expenses incurred by the City in such suit, including reasonable attorneys' fees, court costs, expert witness fees and investigation expenses.

This bond shall inure to the benefit of any of the persons named in Civil Code Section 9100 so as to give a right of action to such persons or their assigns in any suit brought upon this bond.

It is further stipulated and agreed that the Surety on this bond shall not be exonerated or released from the obligation of this bond by any change, extension of time for performance, addition, alteration or modification in, to, or of any Contract, plans, specifications, or agreement pertaining

or relating to any scheme or work of improvement herein above described, or pertaining or relating to the furnishing of labor, materials, or equipment therefore, nor by any change or modification of any terms of payment or extension of the time for any payment pertaining or relating to any scheme or work of improvement herein above described, nor by any rescission or attempted rescission or attempted rescission of the Contract, agreement or bond, nor by any conditions precedent or subsequent in the bond attempting to limit the right of recovery of claimants otherwise entitled to recover under any such Contract or agreement or under the bond, nor by any fraud practiced by any person other than the claimant seeking to recover on the bond and that this bond be construed most strongly against the Surety and in favor of all persons for whose benefit such bond is given, and under no circumstances shall Surety be released from liability to those for whose benefit such bond has been given, by reason of any breach of Contract between the owner or City and original Contractor or on the part of any obligee named in such bond, but the sole conditions of recovery shall be that claimant is a person described in Civil Code Section 9100, and has not been paid the full amount of his claim and that Surety does hereby waive notice of any such change, extension of time, addition, alteration or modification herein mentioned, including but not limited to the provisions of sections 2819 and 2845 of the California Civil Code.

By their signatures hereunder, Surety and Principal hereby confirm under penalty of perjury that surety is an admitted surety insurer authorized to do business in the State of California.

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

Contractor/ Principal

By _____

Title _____

Surety

By _____

Attorney-in-Fact

Title _____

Notary Acknowledgment

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

STATE OF CALIFORNIA
 COUNTY OF _____

On _____, 20___, before me, _____, Notary Public, personally appeared _____, who proved to me on the basis of satisfactory

evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature of Notary Public _____

OPTIONAL

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of this form to another document.

CAPACITY CLAIMED BY SIGNER

DESCRIPTION OF ATTACHED DOCUMENT

- .. Individual
- .. Corporate Officer

- _____ Title(s)
- .. Partner(s) .. Limited
 - .. General

- .. Attorney-In-Fact
- .. Trustee(s)
- .. Guardian/Conservator
- .. Other:

Signer is representing:
 Name Of Person(s) Or Entity(ies)

_____ Title or Type of Document

_____ Number of Pages

_____ Date of Document

Signer(s) Other Than Named Above

NOTE: This acknowledgment is to be completed for Contractor/Principal.

Notary Acknowledgment

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

STATE OF CALIFORNIA
 COUNTY OF _____

On _____, 20___, before me, _____, Notary Public, personally appeared _____, who proved to me on the basis of satisfactory

evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature of Notary Public _____

OPTIONAL

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of this form to another document.

CAPACITY CLAIMED BY SIGNER

DESCRIPTION OF ATTACHED DOCUMENT

- Individual
- Corporate Officer

- | | |
|---|----------------------------------|
| | Title(s) |
| <input type="checkbox"/> Partner(s) | <input type="checkbox"/> Limited |
| <input type="checkbox"/> Attorney-In-Fact | <input type="checkbox"/> General |
| <input type="checkbox"/> Trustee(s) | |
| <input type="checkbox"/> Guardian/Conservator | |
| <input type="checkbox"/> Other: | |

	Title or Type of Document
	Number of Pages
	Date of Document

Signer is representing:
 Name Of Person(s) Or Entity(ies)

Signer(s) Other Than Named Above

NOTE: This acknowledgment is to be completed for the Attorney-in-Fact. The Power-of-Attorney to local representatives of the bonding company must also be attached.

END OF PAYMENT BOND

F. GUARANTEE TO THE CITY OF HERMOSA BEACH

CIP No. 689 CLARK BUILDING RENOVATIONS

As a material inducement to the City to award the Contract for CIP No. _____ to the _____, the undersigned (“Guarantor”) has agreed to enter into this guarantee. The Guarantor hereby unconditionally guarantees to the fullest extent allowed by law the following work included in this project: _____ (“the work”).

Guarantor guarantees that the materials and equipment used by itself and its sub-Contractors will be free from defects and that the work will conform to the plans and specifications. Should any of the materials or equipment prove defective or should the work as a whole, or any part thereof, prove defective for any reason whatsoever (except due to intentional torts by the City), or should the work as a whole or any part thereof fail to operate properly or fail to comply with the plans and specifications, Guarantor will, at the City’s sole election: 1) reimburse the City, upon written demand, for all of the City’s expenses incurred replacing or restoring any such equipment or materials, including the cost of any work necessary to make such replacement or repairs; or 2) replace any such defective material or equipment and repair said work completely, all without any cost to the City. Guarantor further guarantees that any such repair work will conform to the plans and specifications for the project. This guarantee will remain in effect for one year from the date on which the Contract for the work is accepted by the City.

Guarantor understands and agrees that the City shall have the unqualified option to make any replacements or repairs itself or to have such replacement, repair, performed by the undersigned. The City shall have no obligation to consult with Guarantor before the City proceeds to perform any repair, replacement, or work itself. If the City elects to have Guarantor perform said repair, replacement, or work, Guarantor agrees that the repair, replacement, or work shall be performed within 15 days after receipt of a written demand from the City.

If the City elects to perform the replacement, repairs itself, Guarantor agrees to make reimbursement payment within 15 days after receipt of a written demand for payment from the City.

If the Guarantor fails or refuses to comply with this guarantee, the City shall be entitled to all costs and expenses, including attorneys and expert fees, reasonably incurred by reason of Guarantor’s failure or refusal.

Guarantor

Contractor

Date

By

Title

**G. GENERAL COMPREHENSIVE LIABILITY ADDITIONAL INSURED
ENDORSEMENT**

CIP No. 689 CLARK BUILDING RENOVATIONS

NAME OF ADDRESS OF INSURED:

General description of agreement(s) and/or activity(ies) insured:

Notwithstanding any inconsistent statement in the policy to which this endorsement is attached or in any endorsement now or hereafter attached thereto, it is agreed as follows:

1. That the City of Hermosa Beach and its or their elected officials, officers, agents and employees are insureds thereunder in relation to those activities described generally above with regard to operations performed by or on behalf of the named insured.
2. Such insurance shall be primary, and not contributing with any other insurance maintained by the City.
3. The policy to which this endorsement is attached shall apply separately to each insured against whom claim is made or suit is brought except with respect to the limits of the company's liability.
4. The policy to which this endorsement is attached shall not be subject to cancellation, change in coverage, reduction of limits or non-renewal except after written notice to Risk Management, City of Hermosa Beach, by certified mail, return receipt requested, not less than thirty (30) days prior to the effective date thereto.

CANCELLATION NOTICE AND ENDORSEMENT TO BE SENT TO:

Risk Management
City of Hermosa Beach
1315 Valley Dr. Hermosa
Beach, CA 90254
(310) 318-0202

Except as stated above and not in conflict with this endorsement, nothing contained herein shall be held to waive, alter or extend any of the limits, agreements, or exclusions of the policy to which this endorsement is attached.

Endorsement No. _____ Effective Date _____ Policy No. _____

TYPE OF COVERAGES TO WHICH LIMITS OF THIS ENDORSEMENT ATTACHES LIABILITY _____ POLICY PERIOD FROM _____ TO _____

Scheduled items or locations are to be identified on an attached sheet.

The following inclusions relate to the above coverages includes:

- Premises & Operations
- Contractual Liability
- Independent Contractors
- Products/Completed Operations
- Broad Form Property Damage
- Broad Form Liability Endorsement
- Explosion Hazard
- Collapse
- Underground Hazard
- Personal Injury
- _____

A deductible or self-insured retention (strike out one) of _____ applies to _____ coverage.

DEDUCTIBLE APPLIES PER CLAIM, _____ PER OCCURRENCE _____

INSURANCE COMPANY
ADDRESS: _____

I, _____, (print name) hereby declare under penalty of perjury, under the laws of the State of California, that I have the authority to bind the above-named insurance company to this endorsement and by my execution hereof, do so bind said company.

Signature of Authorized Representative (Original Signature only; No facsimile signature or initialed signature accepted)

Executed at _____, _____ on _____, _____ 20 .

Phone No.: () _____

H. AUTOMOBILE LIABILITY ADDITIONAL INSURED ENDORSEMENT

CIP No. 689 CLARK BUILDING RENOVATIONS

NAME OF ADDRESS OF INSURED:

General description of agreement(s) and/or activity(ies) insured:

Notwithstanding any inconsistent statement in the policy to which this endorsement is attached or in any endorsement now or hereafter attached thereto, it is agreed as follows:

1. That the City of Hermosa Beach and its or their elected officials, officers, agents and employees are insureds thereunder in relation to those activities described generally above with regard to operations performed by or on behalf of the named insured.
2. Such insurance shall be primary, and not contributing with any other insurance maintained by the City.
3. The policy to which this endorsement is attached shall apply separately to each insured against whom claim is made or suit is brought except with respect to the limits of the company's liability.
4. The policy to which this endorsement is attached shall not be subject to cancellation, change in coverage, reduction of limits or non-renewal except after written notice to Risk Management, City of Hermosa Beach, by certified mail, return receipt requested, not less than thirty (30) days prior to the effective date thereto.

CANCELLATION NOTICE AND ENDORSEMENT TO BE SENT TO:

Risk Management
City of Hermosa Beach
1315 Valley Dr. Hermosa
Beach, CA 90254
(310) 318-0202

Except as stated above and not in conflict with this endorsement, nothing contained herein shall be held to waive, alter or extend any of the limits, agreements, or exclusions of the policy to which this endorsement is attached.

Endorsement No. _____	Effective Date _____	Policy No. _____
-----------------------	----------------------	------------------

TYPE OF COVERAGES TO WHICH LIMITS OF THIS ENDORSEMENT ATTACHES <u>LIABILITY</u>	POLICY PERIOD FROM _____ TO _____
--	--------------------------------------

Scheduled items or locations are to be identified on an attached sheet.

The following inclusions relate to the above coverages includes:

- Owned Automobiles
- Non-owned Automobiles
- Hired Automobiles
- Owned, Non-owned and Hired Automobiles

A deductible or self-insured retention (strike out one) of _____ applies to _____ coverage.

DEDUCTIBLE APPLIES PER CLAIM, _____ PER OCCURRENCE _____

INSURANCE COMPANY
ADDRESS: _____

I, _____, (print name) hereby declare under penalty of perjury, under the laws of the State of California, that I have the authority to bind the above-named insurance company to this endorsement and by my execution hereof, do so bind said company.

Signature of Authorized Representative (Original Signature
only; No facsimile signature or initialed signature accepted)

Executed at _____, _____ on _____ 20 .

Phone No.: () _____

**I. INSTRUCTIONS FOR COMPLETING, EXECUTING, AND SUBMITTING
EVIDENCE OF INSURANCE TO THE OWNER**

CIP No. 689 CLARK BUILDING RENOVATIONS

Insured: _____ Date: _____
(Contractor, Lessee, Permittee, etc.)

Insured

- A. In order to reduce problems and time delays in providing evidence of insurance to the City, you are requested to give your insurance agent or broker a copy of the attached Insurance Requirements and endorsement forms along with these instructions for completing, executing, and submitting evidence of insurance.

If the agreement requires Workers' Compensation coverage and you have been authorized by the State of California to self-insure Workers' Compensation, then a copy of the certificate from the State authorizing self-insurance for Workers' Compensation shall meet the requirements for Workers' Compensation insurance covering activities within the State of California.

All questions relating to insurance should be directed to the department or office responsible for your Contract, lease, permit, or other agreement.

Insurance Agent or Broker

- B. The appropriate Endorsement Form shall be used. No changes in the terms of the Endorsement will be permitted. Certificates of Insurance alone will not be accepted by the City.

More than one insurance policy may be required to comply with the insurance requirements. Endorsement forms appropriate to your insured's Contract, lease or permit are checked below and enclosed.

- Workers' Compensation/Employers Liability
- General Liability
- Automobile Liability
- Excess/umbrella Liability
- Professional Liability
- Property insurance
- Fine Arts Property Insurance

You shall have an authorized representative of the insurance company sign the completed endorsement forms, note his phone number at the bottom of page 2 and have said representative transmit the forms to the City. Signatures must be originals as the City will not accept facsimile (rubber stamp, photocopy, etc.) or initialed signatures.

The name of the Insurance Company underwriting the coverage and its address shall be noted on page 2 of the endorsement form.

The "General description of agreement(s) and/or activity(ies) insured" shall include reference to the activity and/or to either the specific City Contract number, lease number, permit number or construction approval number.

The coverages and limits for each type of insurance are specified in the attached sheet of insurance requirements. When coverage is on a scheduled basis, then a separate sheet is to be attached to the endorsement listing such scheduled locations, vehicles, etc., so covered.

Endorsements to excess policies will be required when primary insurance is insufficient in complying with the City's requirements.

If there is insufficient space on the form to note pertinent information, such as inclusions, exclusions or specific provisions, etc., a separate sheet may be attached.

When additional sheets are attached, change the number of pages at the bottom of the form.

Completed Endorsement(s) and questions relating to the required insurance are to be directed to:

Risk Management
City of Hermosa Beach
1315 Valley Dr. Hermosa
Beach, CA 90254
(310) 318-0202

Improperly completed Endorsements will be returned to your insured for correction by an authorized representative of the insurance company.

DELAY IN SUBMITTING PROPERLY COMPLETED ENDORSEMENT FORMS MAY DELAY YOUR INSURED'S INTENDED OCCUPANCY OR OPERATION UNDER AGREEMENT WITH THE OWNER.

For extensions or renewals of insurance policies which have the City's Endorsement Form(s) attached, the City will accept a copy of the endorsement (with an original signature) to extend the period of coverage as evidence of continued coverage.

J. WORKER'S COMPENSATION INSURANCE CERTIFICATE

CIP No. 689 CLARK BUILDING RENOVATIONS

The Contractor shall execute the following form as required by the California Labor Code, Sections 1860 and 1861:

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

DATED: _____

CONTRACTOR: _____

By: _____

Signature

Title

ATTEST:

By: _____

Signature

Title

K. SUPPLEMENTAL INFORMATION TO BE COMPLETED BY PRINCIPAL

CIP No. 689 CLARK BUILDING RENOVATIONS

If an individual, so state. If a firm or co-partnership, state the firm and give the names of all individual co-partners composing the partnership. If a corporation, state legal name of corporation; state also the names of the president, secretary, treasurer, and manager thereof.

Business Address:

Telephone Number:

Date:

Print Name:

Principal

Signature:

L. W9 FORM

Form W-9 (Rev. October 2018) Department of the Treasury Internal Revenue Service	Request for Taxpayer Identification Number and Certification ▶ Go to www.irs.gov/FormW9 for instructions and the latest information.	Give Form to the requester. Do not send to the IRS.
--	---	--

Print or type. See Specific Instructions on page 3.	1 Name (as shown on your income tax return). Name is required on this line; do not leave this line blank.	
	2 Business name/disregarded entity name, if different from above	
	3 Check appropriate box for federal tax classification of the person whose name is entered on line 1. Check only one of the following seven boxes. <input type="checkbox"/> Individual/sole proprietor or single-member LLC <input type="checkbox"/> C Corporation <input type="checkbox"/> S Corporation <input type="checkbox"/> Partnership <input type="checkbox"/> Trust/estate <input type="checkbox"/> Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=Partnership) ▶ _____ Note: Check the appropriate box in the line above for the tax classification of the single-member owner. Do not check LLC if the LLC is classified as a single-member LLC that is disregarded from the owner unless the owner of the LLC is another LLC that is not disregarded from the owner for U.S. federal tax purposes. Otherwise, a single-member LLC that is disregarded from the owner should check the appropriate box for the tax classification of its owner. <input type="checkbox"/> Other (see instructions) ▶ _____	4 Exemptions (codes apply only to certain entities, not individuals; see instructions on page 3): Exempt payee code (if any) _____ Exemption from FATCA reporting code (if any) _____ <i>(Applies to accounts maintained outside the U.S.)</i>
	5 Address (number, street, and apt. or suite no.) See instructions.	Requester's name and address (optional)
	6 City, state, and ZIP code	
	7 List account number(s) here (optional)	

Part I Taxpayer Identification Number (TIN)	Social security number					
Enter your TIN in the appropriate box. The TIN provided must match the name given on line 1 to avoid backup withholding. For individuals, this is generally your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the instructions for Part I, later. For other entities, it is your employer identification number (EIN). If you do not have a number, see <i>How to get a TIN</i> , later.	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; height: 20px;"> </td> <td style="width: 3%; text-align: center;">-</td> <td style="width: 33%; height: 20px;"> </td> <td style="width: 3%; text-align: center;">-</td> <td style="width: 29%; height: 20px;"> </td> </tr> </table>		-		-	
	-		-			
Note: If the account is in more than one name, see the instructions for line 1. Also see <i>What Name and Number To Give the Requester</i> for guidelines on whose number to enter.	or Employer identification number <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; height: 20px;"> </td> <td style="width: 3%; text-align: center;">-</td> <td style="width: 33%; height: 20px;"> </td> <td style="width: 3%; text-align: center;">-</td> <td style="width: 29%; height: 20px;"> </td> </tr> </table>		-		-	
	-		-			

Part II Certification	
Under penalties of perjury, I certify that:	
1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me); and	
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding; and	
3. I am a U.S. citizen or other U.S. person (defined below); and	
4. The FATCA code(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct.	
Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions for Part II, later.	
Sign Here	Signature of U.S. person ▶ _____ Date ▶ _____

General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Future developments. For the latest information about developments related to Form W-9 and its instructions, such as legislation enacted after they were published, go to www.irs.gov/FormW9.

Purpose of Form

An individual or entity (Form W-9 requester) who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) which may be your social security number (SSN), individual taxpayer identification number (ITIN), adoption taxpayer identification number (ATIN), or employer identification number (EIN), to report on an information return the amount paid to you, or other amount reportable on an information return. Examples of information returns include, but are not limited to, the following.

- Form 1099-DIV (dividends, including those from stocks or mutual funds)
- Form 1099-MISC (various types of income, prizes, awards, or gross proceeds)
- Form 1099-B (stock or mutual fund sales and certain other transactions by brokers)
- Form 1099-S (proceeds from real estate transactions)
- Form 1099-K (merchant card and third party network transactions)
- Form 1098 (home mortgage interest), 1098-E (student loan interest), 1098-T (tuition)
- Form 1099-C (canceled debt)
- Form 1099-A (acquisition or abandonment of secured property)

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN.

If you do not return Form W-9 to the requester with a TIN, you might be subject to backup withholding. See What is backup withholding, later.

CIP No. 689

CLARK BUILDING RENOVATIONS

VI. SPECIAL PROVISIONS

The following Special Provisions supplement and amend the 2021 Standard Specifications for Public Works Construction (SSPWC). These Special Provisions have been arranged into a format and sequence that parallels the Standard Specifications for Public Works Construction.

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PART 1 – GENERAL PROVISIONS

PREFACE: STANDARD SPECIFICATIONS AND STANDARD DRAWINGS

The Standard Specifications for Public Works Construction (SSPWC), written and promulgated by the Southern California Chapter of the American Public Works Association and the Southern California Districts of the Associated General Contractors of California, shall be the Standard Specifications of the Owner. All work shall conform to the edition indicated in this document and in the bid proposal documents, including supplements, of the SSPWC, these Special Provisions which supplement or modify the SSPWC, the Standard Plans for Public Works Construction (SPPWC) of the same edition as the SSPWC, and the Standard Drawings as issued by the City available at the time bids are opened unless otherwise specified in the Contract Documents.

The above referenced Standard Specifications, Special Provisions and Standard Drawings are hereby made a part of the Contract Documents.

SECTION 1 – GENERAL

1-2 TERMS AND DEFINITIONS.

Whenever the following terms are used in the SSPWC, they shall be understood to mean and refer to the following:

- a) Board – The City Council of the City of Hermosa Beach
- b) Contract Documents – Documents including but not limited to the proposal forms, Special Provisions, Bonds, Insurance, Contract, and all Addenda setting forth any modifications to the documents.
- c) Engineer – The Director of Public Works/City Engineer or their authorized representative
- d) Bidder – An individual, co-partnership, association, or corporation submitting a proposal for the work contemplated, acting directly or through a duly authorized representative.
- e) Legal Address of Contractor – The address given on the Contractor's bid and is hereby designated as the place to which all notices, letters or other communications to the Contractor shall be mailed or delivered.

SECTION 2 – SCOPE OF THE WORK.

2-2 PERMITS.

Add the following:

Prior to beginning work, the Contractor shall obtain authorization and permits from the City of Hermosa Beach. The Contractor will be responsible to protect and preserve all property and improvements in accordance with the Contract Documents.

The Contractor must have or obtain a valid City of Hermosa Beach Business License in accordance with the provisions of the Hermosa Beach Municipal Code.

Building Permit

A Building Permit is required to work within a building structure and will be issued at no cost to

the Contractor.

Electrical/Plumbing/Mechanical Permits

Electrical/Plumbing/Mechanical Permits are required to work within a building structure and will be issued at no cost to the Contractor.

City Encroachment/Right of Way Permit

A City Encroachment/Right of Way Permit is required to work within public right-of-way and will be issued at no cost to the Contractor.

Other Encroachment/Right of Way Permits

When work occurs in the right-of-way of other entities, the Contractor shall obtain a no fee right of way permit as required for an encroachment from that entity.

2-5 THE CONTRACTOR’S EQUIPMENT AND FACILITIES.

2-5.4 Haul Routes.

Replace the entire subsection with the following:

Haul Routes shall be per the City of Hermosa Beach Truck Routes map.

Add the following subsections:

2-5.5 Contractor’s Responsibility for Work.

Until the formal acceptance of the work by the City, the Contractor shall have the charge and care thereof and shall, subject to the insurance protection furnished, bear the risk of accident, loss or damage to any part thereof by action of the elements or from any other cause, whether arising from the execution or from the non-execution of the work. The Contractor shall rebuild, repair, restore and otherwise correct damages to any portion of the work occasioned by any of the above causes before its acceptance.

In case of suspension of work from any cause whatever, the Contractor shall be responsible for all materials and the proper temporary storage thereof.

2-5.6 Notice and Service Thereof.

Any notice required or given by one party to the other under the Contract shall be in writing and shall be dated and signed by the party giving such notice or by a duly authorized representative of such party. Any such notice shall not be effective for any purpose whatever unless served in the following manner:

Notice shall be given to the City by personal delivery thereof to the City’s Engineer or by depositing the same in the United States mail enclosed in a sealed envelope, registered and with postage prepaid, addressed to:

Public Works Department
City of Hermosa Beach
1315 Valley Dr.
Hermosa Beach, CA 90254

Notice shall be given to the Contractor by personal delivery thereof to said Contractor or to his authorized representative at the site of the project, or by depositing the same in the United States mail, enclosed in a sealed envelope addressed to said Contractor at the address established for the conduct of the work under this Contract, postage prepaid and registered.

Notice shall be given to the Surety, or any other person, by personal delivery to said Surety or other person, or by depositing the same in the United States Mail, enclosed in a sealed envelope addressed to such Surety or persons at the address of said Surety or persons last communicated to the party giving the notice, postage prepaid and registered.

2-5.7 Warranty of Title.

No materials, supplies, or equipment for the work under this Contract shall be purchased subject to any chattel mortgage or under a conditional sale contract or other agreement by which an interest therein or any part thereof is retained by the seller or supplier. The Contractor warrants clear and good title to all materials, supplies, and equipment installed and incorporated in the work, and agrees upon completion of all work to deliver the premises, together with all improvements and appurtenances constructed or placed thereon by them to the City free from any claims, liens, encumbrances, or charges, and further agrees that neither they nor any person, firm, or corporation furnishing any material or labor for work covered by the Contract shall have any right to a lien upon the premises or any improvement or appurtenance thereon; provided, that this shall not preclude the Contractor from installing metering devices or other equipment of utility companies the title of which is commonly retained by the utility company.

Nothing contained in this section, however, shall defeat or impair the right of such persons furnishing materials or labor under any bond given by the Contractor for their protection, or any right under any law permitting such persons to look to funds due the Contractor, which are in the hands of the City.

2.11 RETENTION OF IMPERFEFCT WORK.

If any portion of the work done or materials furnished under the contract proves defective or not in accordance with the specifications and contract drawings, and if the imperfection in the same is not of sufficient magnitude or importance to make the work dangerous or undesirable, or if the removal of such work is impracticable or will create conditions which are dangerous or undesirable in the opinion of the Engineer, the Engineer shall have the right and authority to retain the work instead of requiring it to be removed and reconstructed, but he shall make such deductions therefor in the payment due the Contractor as may be just and reasonable.

SECTION 3 – CONTROL OF THE WORK.

3-6 THE CONTRACTOR’S REPRESENTATIVE.

Add the following:

The Contractor shall provide the Engineer with the name, address, and business and home telephone numbers of the person responsible for the maintenance of barricades, traffic control signs, lights and other safety devices.

3-7 CONTRACT DOCUMENT.

3-7.2 Precedence of Contract Documents.

Replace the entire subsection with the following:

If there is a conflict between any of the Contract Documents, the document highest in the order of precedence shall control. The order of precedence, from highest to lowest, shall be as follows:

1. Requirements of law, including the Code and Ordinances of the City of Hermosa Beach.
2. Permits from other agencies as may be required by law.
3. Permits from City of Hermosa Beach Departments as may be required by law or ordinance.
4. The Contract.
5. The Bid Proposal.
6. Addenda.
7. Notice Inviting Bids.
8. Instructions to Bidders.
9. Special and General Provisions.
10. Plans.
11. City of Hermosa Beach Standard Plans.
12. Other Standard Plans.
13. Standard Specifications for Public Works Construction.
14. Reference Specifications.

Change orders, supplemental agreements, and approved revisions to Plans and Specifications will take precedence over documents listed above, except those listed as FIRST, SECOND, and THIRD. Detailed plans shall have precedence over general plans.

3-8 SUBMITTALS.

3-8.1 General.

Add the following:

The Contractor shall submit the following submittals within ten (10) days of notification of the City's intent to award this contract:

- Project Construction Schedule, sequence, and phase sequence plan
- Preconstruction video on USB, 2 copies
- Copy of City Business License (Prime and Subcontractors)
- 24 Hr. Emergency Phone Call List
- Letters identifying site authorized contractor's representative or "Superintendent" and contractor's "Competent Person"
- WPCP / Best Management Practices

- All submittals required as per Technical Specifications section of this document and project plans including seismic bracing of owner-furnished office furniture (height of 6 feet or more) utilizing the following (or equal) material:

Clip Angles- 2"x2"x3/16"

Lag Bolts- 1/4"x3"

Sheet Metal Screws- #10

Each piece of furniture to be anchored at top with a minimum of two (2) clip angles.

- And others as requested by the Engineer

3-13 COMPLETION, ACCEPTANCE, AND WARRANTY.

Add the following subsection:

3-13.4 Completion and Acceptance.

In addition to the guarantees as required in Section 2-4 of the Standard Specifications, the Faithful Performance Bond shall remain in full force and effect for a period of one year after acceptance of the work by the Owner to insure that defects, which appear within said period, will be repaired, replaced, or corrected by the Contractor, at its own cost and expense, to the satisfaction of the Engineer within thirty (30) days after written notice thereof by the City.

SECTION 5 - LEGAL RELATIONS AND RESPONSIBILITIES.

5-3 LABOR.

Add the following subsection:

5-3.6 Laws.

Each bidder must submit with the Bid Proposal a fully executed Certificate of Non- Discrimination by Contractors. Bids will not be considered unless accompanied by the completed Certificate.

After the opening of bids and the determination of the low bidder, said low bidder shall submit to the Public Works Department, no later than 5:00 P.M. on the third working day following the bid opening, a completed "Fair Employment Practices Contractor Compliance Report".

The Contractor shall comply with all applicable provisions of Sections 1776, 1777.5 and 1777.7 of the California Labor Code. The Contractor shall be responsible for compliance with Section 1776 and shall insert a provision in all subcontracts requiring subcontractors to comply with said section.

The Contractor is prohibited from performing work on this project with a subcontractor who is ineligible to perform work on the project pursuant to Section 1777.1 or 1777.7 of the Labor Code.

5-4 INSURANCE.

Replace the entire subsection with the following:

The Contractor shall, at its expense, maintain in effect all times during the performance of

work under the Contract not less than the following coverage and limits of insurance, which shall be maintained with insurers licensed to sell insurance in the State of California and having a “A-“or higher rating in the latest edition of Best’s Insurance Guide, and shall be subject to approval by the City’s Risk Manager:

Workers’ Compensation and Employer’s Liability

- Workers’ Compensation – coverage as required by law
- Employer’s Liability – limits of at least \$1,000,000 per occurrence

Comprehensive General Liability

- Combined Single Limit - \$2,000,000

Automobile Liability

- Combined Single Limit - \$1,000,000

The automobile and general comprehensive liability policies may be combined in a single policy with a combined single limit of \$1,000,000.

All of the Contractor’s policies shall contain an endorsement providing written notice shall be given to the City at least 30 calendar days prior to termination, cancellation or reduction of coverage in the policy

The Bodily Injury and Property Damage Liability policies shall contain the following:

1. An endorsement extending coverage to the City as an insured, in the same manner as the named insured as respects liabilities arising out of the performance of any work under the Contract. Such insurance shall be primary insurance as respects the interest of the City, and any other insurance maintained by the City shall be excess and not contributing insurance with the insurance required hereunder.
2. “Severability of Interest” clause.
3. Elimination of any exclusion regarding loss or damage to property caused by explosion or resulting from collapse of buildings or structures or damage to property underground, commonly referred to by insurers as the “XCU” hazards.
4. Provision or endorsement stating that such insurance, subject to all of its other terms and conditions, applies to the liability assumed by the Contractor under the Contract.

Promptly on execution of the Contract, and prior to commencement of any work, the Contractor shall deliver to the City copies of all required policies and endorsements thereto on the forms supplied by the City.

The Contractor shall require and verify similar insurance on the part of its subcontractors.

The foregoing requirements as to the types, limits and City approval of insurance coverage to be maintained by the Contractor are not intended to and shall not in any manner limit or qualify the liabilities and obligation assumed by the Contractor under the Contract.

Any policy or policies of insurance that the Contractor or his Subcontractors elects to carry as insurance against loss or damage to their construction equipment and tools or other personal

property used in fulfillment of this contract shall include a provision waiving the insurer's right of subrogation against the City.

The cost of all insurance shall be included in the contractor's bid.

5-7 SAFETY.

Add the following subsection:

5-7.9 Emergency Provisions.

Unusual conditions may arise on the work which will require that immediate and unusual provision be made to protect the public from danger or loss or damage to life and property, due directly or indirectly to the prosecution of the work, and it is part of the service required of the Contractor to make such provisions and to furnish such protection.

Whenever, in the opinion of the City, an emergency exists of which the City is aware and against which the Contractor has not taken sufficient precaution for the safety of the public or the protection of utilities or of adjacent structures or property which may be injured by the progress of construction; and whenever, in the opinion of the City, immediate action shall be considered necessary in order to protect public or private personnel or property interests, or prevent likely loss of human life or damage on account of the operations under the Contract, then in that event the City may provide suitable protection to said interests by causing such work to be done and material to be furnished, as in the opinion of the City may seem reasonable and necessary, all at the expense of the Contractor.

Add the following subsections:

5-8 LAWS TO BE OBSERVED.

5-8.1 Laws and Regulations.

The Contractor shall keep himself fully informed of all Federal and State laws, County and City ordinances and regulations which, in any manner, affect those engaged or employed on the work, the materials used in the work or the conduct of the work. If any discrepancy or inconsistency should be discovered in this contract or in the Plans or Specifications herein referred to, in relation to any such law, ordinance or regulation, the Contractor shall forthwith report the same in writing to the Engineer. The Contractor shall, at all times, observe and comply with and shall cause all his agents and employees to observe and comply with all such applicable laws, ordinances and regulations in effect or which may become effective before completion of this contract. He shall protect and indemnify the City and its officers and agents against any claim or liability arising from or based on the violations of any such laws, ordinances or regulations whether by himself or by his employees or his subcontractors or their employees.

Except as otherwise explicitly provided in these specifications, all permits and licenses necessary to the prosecution of the work shall be secured by the Contractor at his own expense and he shall pay all taxes properly assessed against his equipment or property used or required in connection with the work.

All state laws, all county and city ordinances and regulations now imposed by competent authority and relating to any materials required to be furnished under these specifications and works required to be done hereunder, shall be deemed to be and hereby are made controlling and

part of these specifications.

5-8.2 General.

The Contractor shall keep himself fully informed of all existing state and national laws and municipal ordinances and regulations which in any manner affect those engaged or employed in the work, or the materials used in the work or which in any way affect the conduct of the work and of all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the same.

5-8.3 Eight-Hour Law.

Eight (8) hours labor constitutes a legal day's work. The Contractor shall forfeit as a penalty \$25.00 (Twenty-five dollars) for each workman employed in the execution of the contract by the Contractor or any subcontractor under him for each calendar day during which such workman is required or permitted to work more than eight (8) hours in any one calendar day and forty (40) hours in any one calendar week in violation of the provisions of the Labor Code and in particular, Section 1810 to Section 1815 thereof inclusive except that work performed by employees of Contractors in excess of eight (8) hours per day and forty (40) hours during any one week, shall be compensated at not less than one and one-half (1 1/2) times the basic rate of pay as provided in Section 1815.

5-8.4 Prevailing Rate of Per Diem Wages.

Pursuant to the provisions of Section 1773 of the Labor Code, the general prevailing wage rates in the County in which the work is to be done have been determined by the Director of the California Department of Industrial Relations. These wages are set forth in the General Prevailing Wage Rates. The Federal Minimum wage rates for this project as predetermined by the United States Secretary of labor are set forth herein by addenda and in copies that may be examined at the offices described above where project plans, special provisions, and proposal forms may be seen. Addenda to modify the federal minimum wage rates, if necessary, will be issued to holders. Future effective general prevailing wage rates which have been predetermined and are on file with the California Department of Industrial Relations are referenced but not printed in the general prevailing wage rates.

Attention is directed to the Federal minimum wage rate requirements in these Special Provisions. If there is a difference between the minimum wage rates predetermined by the Secretary of labor and the general prevailing wage rates determined by the Director of the California Department of Industries Relations for similar classifications of labor, the Contractor and subcontractor shall pay not less than the higher wage rate. The City will not accept lower State wage rates not specifically included in the Federal minimum wage determination. This includes "helper" (or other classifications based on hours of experience) or any other classifications not appearing in the Federal wage rate determination. Where Federal wage determinations do not contain the State wage rate determination otherwise available for use by the Contractor and subcontractor, the Contractor and subcontractor shall pay not less than the Federal minimum wage rate which most closely approximates the duties of the employees in question.

The U.S. Department of Transportation (DOT) provides a toll-free "hotline" service to report bid rigging activities. Bid rigging activities can be reported Mondays through Fridays, between 8:00 a.m. and 5:00 p.m., eastern time, Telephone No. 1-800-424-9071. Anyone with knowledge

of possible bid, bidder collusion, or other fraudulent activities should use the “hotline” to report these activities. The “hotline” is part of the DOT’s continuing effort to identify and investigate highway construction contract fraud and abuse and is operated under the direction of the DOT Inspector General. All information will be treated confidentially and caller anonymity will be respected.

The Contractor shall comply with Labor Code Section 1775. In accordance with said section, the Contractor shall forfeit as a penalty to the City \$50.00 (fifty dollars) for each calendar day, or portion thereof, for each workman paid less than the stipulated prevailing rates for such work or craft in which such workman is employed for any work done under the contract by him or by any subcontractor under him in violation of the provisions of the Labor Code and in particular Labor Code Sections 1770 to 1780, inclusive. In addition to said penalty and pursuant to said Section 1775, the difference between such stipulated prevailing wage rates and the amount paid to each workman for each calendar day or portion thereof for which each workman was paid less than the stipulated prevailing wage rate shall be paid to each workman by the Contractor.

5-8.5 Certified Payroll.

Pursuant to Section 1776 of the Labor Code, the Contractor and/or subcontractors shall submit weekly to the City for each week in which any contract work is performed a certified copy of all payroll records. Should the Contractor fail to provide such payroll certificates, the City may withhold \$1,000.00 for each weekly payroll certificate not received from payment due.

5-9 FAIR EMPLOYMENT PRACTICE COMMISSION CERTIFICATION.

The Contractor's attention is directed to the requirements in Section 12990 of the Government Code for nondiscrimination and compliance employment programs.

SECTION 6 – PROSECUTION AND PROGRESS OF THE WORK.

6-1 CONSTRUCTION SCHEDULE AND COMMENCEMENT OF THE WORK.

6-1.1 Construction Schedule.

Add the following:

The Contractor’s proposed construction schedule shall be submitted to the Engineer within ten (10) working days after the date of the Notice of Contract Approval. The schedule shall be supported by written statements from each supplier of materials or equipment indicating that all orders have been placed and acknowledged, and setting forth the dates that each item will be delivered.

In preparation of the construction schedule, the following items shall be considered:

- The City observes the following holidays, which shall be considered non-working days. If the Contractor elects to work on any of the City holidays the Contractor shall be responsible for paying any associated inspection costs, including overtime and holiday premiums. **Any work not completed and fully open to public traffic shall be maintained in a safe and delineated condition. Traffic control and safety devices shall be maintained at all times.**

- New Year's Day
- Martin Luther King Jr.'s Birthday
- Washington's Birthday
- Cesar Chavez Day
- Memorial Day
- Juneteenth
- Independence Day
- Labor Day
- Veterans Day
- Thanksgiving
- Christmas Day
- The Contractor's working hours shall be limited to the hours between 8:00 A.M. and 5:00 P.M., Monday through Friday. Deviation from normal working hours will not be allowed unless written permission has been duly obtained beforehand from the office of the City Engineer. The Contractor shall provide adequate light for proper prosecution of the work, for the safety of the workmen and the public, and for proper inspection.
- In the event of either a requested or emergency deviation, inspection service fees will be charged against the Contractor. The service fees will be calculated at overtime rates including benefits, overhead and travel time. The service fees will be deducted from any amounts due to the Contractor.

Prior to issuing the Notice to Proceed, the Engineer will schedule a preconstruction meeting with the Contractor to review the proposed construction schedule and delivery dates, arrange utility coordination, discuss construction methods and clarify inspection procedures.

The names, addresses, and telephone numbers of the Contractor and subcontractors, or their representatives, shall be filed with the Public Works Manager and the County Sheriff's Department or the City Police Department prior to beginning work.

The Contractor shall also notify the City of Hermosa Beach and the owners of all utilities and substructures not less than 72 hours prior to starting construction. The following utility companies list of names and telephone numbers is intended for the convenience of the contractor and is not guaranteed to be complete or correct:

Southern California Edison Co.	310/783-9332
The Gas Co.	310/605-7837
Verizon	818/837-0394
Hermosa Beach Police & Fire	310/524-2750
Time Warner (Cable TV)	310/216-4184
West Basin Municipal Water District	310/217-2411
Athens Services	626/934-4696
California Water Service Co.	310/257-1428
Underground Service Alert	800/227-2600

Los Angeles County Flood Maintenance 562/861-0316
Los Angeles County Public Works 626/458-3109

The Contractor shall submit periodic Progress Reports to the Director of Public Works by the tenth day of each month. The report shall include an updated Construction Schedule. Any deviations from the original schedule shall be explained. Progress payments will be withheld pending receipt of any outstanding reports.

6-4.3 Payment for Delays.

To the furthest extent permitted by law, replace the entire subsection with the following:

In compliance with the provisions of California Public Contract Code § 7102, the Contractor will be compensated for damages incurred due to delays in completing the Work due solely to the fault of the City, where such delay is unreasonable under the circumstances and not contemplated by the parties. The Contractor and City agree that determining actual damages is impracticable and extremely difficult. As such, the Contractor shall be entitled to the appropriate time extension and to payment of liquidated damages in the sum of \$1,200 per Day of delay in excess of the time specified for the Completion of the Work. Such amount shall constitute the only payment allowed and shall necessarily include all overhead (direct or indirect), all profit, all administrative costs, all bond costs, all labor, materials, equipment and rental costs, and any other costs, expenses and fees incurred or sustained as a result of such delay. The Contractor expressly agrees to be limited solely to the liquidated damages for all such delays as defined in this subsection.

6-9 LIQUIDATED DAMAGES.

Add the following:

The amount of liquidated damages is hereby amended to **\$1,200** for each consecutive calendar day.

SECTION 7 – MEASUREMENT AND PAYMENT.

7-3 PAYMENT.

7-3.2 Partial and Final Payment.

Replace the entire subsection with the following:

The closure date for periodic progress payments shall be the twenty-fifth day of each month. Authorization to pay is commonly received on the tenth day of the following month. However, payments will be withheld pending receipt of any outstanding reports required by the Contract Documents.

7-3.4 Mobilization.

Replace the entire subsection with the following:

Mobilization shall include all site visits; preparation of all submittals; BMPs; obtaining all permits, insurance, and bonds; video recording of the site existing conditions; moving onto the site all materials and equipment; set up of any temporary facilities (e.g. sanitary facilities, parking, construction water, equipment and materials staging area, fencing); distribution of all

notification materials; removal of same at completion of the work; site cleanup; and other work as required to perform and complete the work.

No material, equipment, or vehicles to be left overnight on sidewalks or streets.

A minimum of one week prior to the start of construction, the Contractor shall video record all areas where construction is to take place. Such video recordings shall be provided to the Engineer before construction commences. These video recordings shall serve as a record of the existing conditions for disputes arising from restoration and should therefore be taken along the line of construction and site access and staging areas at sufficient detail as necessary to clearly depict details of existing conditions. Video recordings shall document existing sidewalks, and adjacent conditions. The video recordings shall be on two USB copies and given to the Engineer. All video recordings shall be indexed and catalogued in such a manner that each photographed area is readily identifiable and shall also indicate the date and time (hour, minutes, and seconds) on which the recording was made. The Contractor shall also video record any unusual conditions encountered during construction that are not already a matter of photographic record. In any areas where existing conditions cannot be determined by means of video recording, the area shall be restored as approved by the Engineer at Contractor's expense. All video recordings shall become the property of the City.

Payment for MOBILIZATION and DEMOBILIZATION is included in the lump sum bid item for completing this project in its entirety including but not limited to furnishing all labor, materials, tools, equipment, transportation, and incidentals for performing all work involved and there shall be no additional payment for mobilization and demobilization.

Add the following subsection:

7-3.9 Work Performed Without Direct Payment.

Tools and materials of any class for which no price is fixed in the Proposal, it shall be understood that such work, equipment, labor, tools and materials shall be provided without extra charge, allowance, or direct payment of any kind. The cost of performing such work or furnishing such equipment, labor, tools, and materials shall be included in the lump sum bid item in the Proposal and no additional compensation will be paid therefor.

7-4.2 Basis for Establishing Costs.

7-4.2.1 Labor.

Replace the entire subsection with the following:

The costs of labor will be the actual cost for wages of workers performing the extra work at the time the extra work is done, plus the employer payments of payroll taxes, health and welfare, pension, vacation, apprenticeship funds, and other direct costs, resulting from Federal, State, or local laws, as well as assessments or benefits required by collective bargaining agreements.

7-4.3 Markup

7-4.3.1 Work by the Contractor.

Replace the entire subsection with the following:

An allowance for overhead and profit shall be added to the Contractor's costs and shall constitute the full and complete markup for all overhead and profit on extra work performed by the Contractor. The Contractor shall also be compensated for the actual increase in the Contractor's bond premium caused by the extra work. The markup shall be:

- a. Labor – 20%
- b. Materials – 15%
- c. Tool and Equipment Rental – 15%
- d. Other Items – 15%

7-4.3.2 Work by a Subcontractor.

When any of the extra work is performed by a subcontractor, the markup shall be applied to the subcontractor's costs. An allowance for the Contractor's overhead and profit shall be added to the sum of the subcontractor's costs and markup and shall constitute the full and complete markup for all overhead and profit for the Contractor on work by the subcontractor. For Contractor markup of subcontractor's costs, the allowance shall be 10% on the first \$2,000 or portion thereof and 5% on costs in excess of \$2,000.

SECTION 9 – SPECIFIC CONDITIONS.

9-1 Work Area

9-1.1 Work Area Access

The subject project site is adjacent to a heavily utilized public sports complex facility. As such the contractor must protect the work area by installing screened temporary chain link fencing and implement other necessary measures to ascertain that access to the work area will be limited to authorized personnel of the contractor its subcontractors and vendors; as well as City representatives only.

9-1.2 Work Area Maintenance

Contractor is only allowed to work between 8 AM and 5 PM - Mondays through Fridays. The contractor shall make every attempt to minimize disturbance to the operation of the adjacent City sports complex and private properties. Contractor shall control construction related dust and noise by installing the necessary separations. Contractor is responsible for daily clean-up of the work and adjacent areas.

9-1.3 Contractor's Temporary Facilities

Contractor will be allowed to utilize the front lawn area of the building (behind the sidewalk) for construction related storage and staging. Contractor must install screened temporary fencing as directed by the City. Contractor shall be responsible for the security of the stored material and equipment. Contractor must ascertain that utilization of the storage and staging will not negatively impact the project's schedule particularly as related to installation of sewer line, stormwater drain line and grease trap structure which are located in the front lawn area of the building.

9-2 Construction Management Software

9-2.1 Procore Software

The contractor shall use the Procore construction management software (with account for the project made available by the City at no additional cost) for various construction management activities related to the project including but not limited to submission of schedules, project material submittals, and RFIs. Project documents including plans and specifications will also be made available on Procore for the contractor's use for the duration of the project.

I. TECHNICAL PROVISIONS

CIP 689 - CLARK BUILDING RENOVATIONS

CITY OF HERMOSA BEACH PUBLIC WORKS DEPARTMENT

OCTOBER 31, 2023

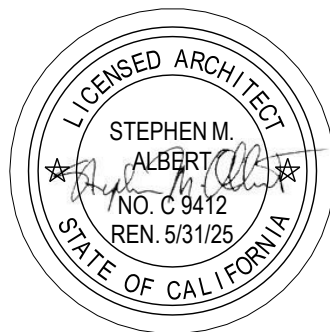


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CIP 689 - Clark Building Renovations

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SECTION 01 3300

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Administrative and procedural requirements for submittals required for the Work, including but not limited to; Shop Drawings, Product Data, Samples, material lists, and quality control items.
- B. Throughout the Contract Documents, the minimum acceptable quality of materials, fabrication, and execution have been defined by the name and catalog number of a manufacturer and by reference of recognized industry standards.
- C. To ensure that specified products are furnished and installed in accordance with the design intent, procedures have been established for submittal of design data and for its review by ARCHITECT, OAR and others.

1.02 RELATED REQUIREMENTS

- A. Section 01 2513: Product Substitution Procedures.
- B. Section 01 2973: Schedule of Values.
- C. Section 01 2976: Progress Payment Procedures.
- D. Section 01 3113: Project Coordination.
- E. Section 01 3213: Construction Schedule.
- F. Section 01 4523: Testing and Inspection.
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- I. Section 01 7123: Field Engineering.
- J. Section 01 7329: Cutting and Patching.

- K. Section 01 7416: Storm Water Pollution Prevention.
- L. Section 01 7700: Contract Closeout.
- M. Section 01 7836: Warranties.

PART 2 – PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 PROCEDURES

- A. CONTRACTOR is required to review and approve every submittal and shop drawing prior to transmittal and delivery to ARCHITECT. Should CONTRACTOR determine a submittal contains errors, or does not meet the requirements of the contract, CONTRACTOR shall immediately return the submittals and shop drawings to the producer and expedite the corrections prior to transmitting the submittal to ARCHITECT. Submittals shall not be used by CONTRACTOR to request clarifications or submit questions. CONTRACTOR will affix stamp to each submittal certifying CONTRACTOR has performed, at minimum, the following:
 - 1. Verified the submittal is complete in all respects and follows the requirements of the Contract Documents without variance.
 - 2. Confirmed that no substitutions have been included. If substitutions are included, CONTRACTOR shall eliminate them from the submittal.
 - 3. Identified any variances from the requirements of the Contract Documents and confirmed that the identified variance meets, but does not exceed the allowable limitations or tolerances as defined in these specifications.
 - 4. Verified that all submitted materials, dimensions and tolerances are compatible with existing or planned conditions of the Work in order to erect, fabricate, or install the submitted assembly in conformance with the requirements of the Contract Documents.
 - 5. Coordinated and verified that the dimensions match CONTRACTOR measured field or installation conditions.
 - 6. Coordinated and verified that the products of separate manufacturers required within any field produced assembly are compatible in all respects for such assembly.

7. Packaged together all related submittals or shop drawings where such is necessary for a comprehensive ARCHITECT review.
- B. CONTRACTOR shall package each submittal appropriately for transmittal and handling. Transmittal format shall be as required by OWNER. CONTRACTOR shall transmit and deliver six sets of each submittal or re-submittal to ARCHITECT, two of which shall be returned to CONTRACTOR. Some specifications may require additional copies be provided. CONTRACTOR shall provide the OWNER additional copies as specified or as requested by OAR. ARCHITECT will not accept submittals received from sources other than from CONTRACTOR.
- C. After ARCHITECT'S review, ARCHITECT will transmit submittals to OAR and OAR shall further distribute to CONTRACTOR, INSPECTOR and others as required. Work shall not commence, unless otherwise approved by OAR, until approved submittals are transmitted to CONTRACTOR.
- D. CONTRACTOR shall clearly identify any deviations from the Contract Documents on each submittal. Any deviation not so noted even though stamped reviewed is not acceptable.
- E. CONTRACTOR shall coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities requiring sequential activity.
- F. Timing of Submittals:
 1. In accordance with General Conditions, CONTRACTOR shall submit to ARCHITECT, with copy of transmittal to the OAR, those Shop Drawings, Product Data, diagrams, materials lists, Samples and other submittals required by the Contract Documents.
 2. The scheduling of submittals shall be sequenced to support the progress of the Work, and shall be:
 - a. Submitted sufficiently in advance of construction, fabrication or installation in order to allow time for transmittal, review, modification, correction, (and resubmission and re-review when required.)
 - b. Phased with adequate time between submittals in order to allow for proper review by the ARCHITECT without negative impact to the Milestones Schedule.
 3. CONTRACTOR shall coordinate submittal of related items and ARCHITECT reserves the right to withhold action on a submittal requiring

coordination with other submittals until all related submittals are received by ARCHITECT.

4. CONTRACTOR shall revise, update and submit submittal schedule to ARCHITECT and OAR on the first of each month, or as required by OAR.
 5. CONTRACTOR shall allow in the Construction Schedule, at least six days for ARCHITECT review following ARCHITECT receipt of submittal. For mechanical, plumbing, electrical, low voltage, fire sprinklers, door and hardware, and other submittals requiring joint review with OAR, CONTRACTOR shall allow a minimum of nine days following ARCHITECT receipt of submittal.
 6. No adjustments to the Contract Time or Milestones will be authorized because of a failure to transmit submittals to ARCHITECT sufficiently in advance of the Work to permit review and processing or where CONTRACTOR fails to provide ARCHITECT submittals on related items.
 7. In case of product substitution, Shop Drawing preparation shall not commence until such time as OWNER accepts or rejects the proposed substitution in accordance with the procedures described in the General Conditions.
- G. If required, resubmit submittals in a timely manner. Resubmit as specified for initial submittal but identify as such. Review times for re-submitted items shall be as per the time frames for initial submittal review.
- H. Shop Drawing preparation shall not commence until such time as CONTRACTOR receives Product Data acceptance.
- I. ARCHITECT will stamp each submittal with a uniform, action stamp. ARCHITECT will mark the stamp appropriately to indicate the action taken, as follows:
1. Final Unrestricted Release: When ARCHITECT marks a submittal “Reviewed” the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
 2. Final-But-Restricted Release: When ARCHITECT, or authorized agent, marks a submittal “Reviewed as Noted,” the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.

3. Returned for Re-submittal: When ARCHITECT, or authorized agent, marks a submittal “Rejected, Revise and Resubmit,” do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat as necessary to obtain different action mark. In case of multiple submittals covering same items of Work, CONTRACTOR is responsible for any time delays, schedule disruptions, out of sequence Work, or additional costs due to multiple submissions of the same submittal item. Do not use, or allow others to use, submittals marked “Rejected, Revise and Resubmit” at the Project site or elsewhere where Work is in progress.
4. Other Action: Where a submittal is for information or record purposes or special processing or other activity, ARCHITECT, or authorized agent, will return the submittal marked “Action Not Required”.

3.02 SHOP DRAWINGS

- A. Shop Drawings are original drawings prepared by CONTRACTOR, Sub-contractor, supplier, or distributor illustrating some portion of Work by showing fabrication, layout, setting, or erection and shall not be based on reproduced Contract Documents or copied standard information.
- B. Produce Shop Drawings to an accurate scale that is large enough to indicate all pertinent features and methods. Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 24 by 36 inches.
- C. Shop Drawings shall include fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings. Include the following information:
 1. Dimensions.
 2. Identification of products and materials included by sheet and detail number.
 3. Compliance with specified standards.
 4. Notation of coordination requirements.
 5. Notation of dimensions established by field measurement.
- D. Provide a space of approximately 4 by 5 inches on the label or beside the title block on Shop Drawings to record CONTRACTOR and ARCHITECT review,

and the action taken. Include the following information on the label for processing and recording action taken:

1. Project name.
 2. Date.
 3. Name and address of ARCHITECT.
 4. Name and address of CONTRACTOR.
 5. Name and address of Subcontractor.
 6. Name and address of supplier.
 7. Name and address of manufacturer.
 8. Name and title of appropriate Specification section.
 9. Drawing number and detail references, as appropriate.
- E. Unless otherwise agreed to or indicated in individual Specification sections, submit a sufficient number of sets to allow for adequate distribution to CONTRACTOR, Sub-Contractor, supplier, manufacturer and fabricators plus four (4) sets (two sets to be retained by ARCHITECT, one set to the INSPECTOR and one set to OAR).

3.03 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of Work or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, wiring diagrams, schedules, illustrations, or performance curves.
1. Mark each copy to show or delineate pertinent materials, products, models, applicable choices, or options. Where Product Data includes information on several products that are not required, clearly mark copies to indicate the applicable information. Include the following information:
 - a. Manufacturer's printed recommendations.
 - b. Compliance with recognized testing agency standards.

- c. Application of testing agency labels and seals.
- d. Notation of dimensions verified by field measurement.
- e. Notation of coordination requirements.
- f. Notation of dimensions and required clearances.
- g. Indicate performance characteristics and capacities.
- h. Indicate wiring diagrams and controls.

2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed by CONTRACTOR.

C. Required Copies and Distribution: Two sets to the AOR and OAR.

3.04 SAMPLES

A. Procedure:

- 1. Submit Samples of sufficient size, quantity, cured and finished and physically identical to the proposed product or material. Samples include partial or full sections or range of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches denoting color, texture, and/or pattern.
 - a. Mount or display Samples in the manner to facilitate review of qualities indicated. Include the following:
 - 1) Specification section number and reference.
 - 2) Generic description of the Sample.
 - 3) Sampling source.
 - 4) Product name or name of manufacturer.
 - 5) Compliance with recognized standards.
 - 6) Availability and delivery time.
- 2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a

comparison of these characteristics between the final submittal and the actual component as delivered and installed.

- a. Where variations in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least three (3) multiple units that show the approximate limits of the variations.
 - b. Refer to other Specification sections for requirements for Samples that illustrate materials, fabrication techniques, assembly details, connections, operation, and similar construction characteristics.
 - c. Refer to other sections for Samples to be returned to CONTRACTOR for incorporation into the Work. Such Samples must be undamaged at time of installation. On the transmittal indicate special requests regarding disposition of Sample submittals.
 - d. Samples not incorporated into the Work, or otherwise not designated as Owner property, remain the property of CONTRACTOR and shall be removed from the Project site prior to Substantial Completion.
3. Color and Pattern: Whenever a choice of color or pattern is available in a specified product, submit accurate color chips and pattern charts to OAR for review and selection.
 4. Number Required: Submit six, minimum, of each. Two will be returned to CONTRACTOR.
- B. When specified, erect field Samples and mock-ups at the Project site to illustrate products, materials, fabrications, or execution and to establish standards by which completed Work shall be judged.
 - C. Maintain sets of Samples, as returned, at the Project site, for quality comparisons throughout the course of the Work. Sample sets may be used to obtain final acceptance of the Work associated with each set.

3.05 QUALITY CONTROL SUBMITTALS

- A. Submit quality control submittals, including design data, certifications, manufacturer's field reports, and other quality control submittals as required under other sections of the Contract Documents.
- B. When other sections of the Contract Documents require manufacturer's certification of a product, material, or installation complies with specified

requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.

- C. Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the represented company.
- D. Requirements for submittal of inspection and test reports are specified in other sections of the Contract Documents.

END OF SECTION

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section includes administrative and procedural requirements governing selection of products for incorporation into the Work.

1.02 RELATED REQUIREMENTS

- A. Section 01 3229 - Project Forms.
- B. Section 01 3113 - Project Coordination.
- C. Section 01 3300 - Submittal Procedures.
- D. Section 01 3213 - Construction Schedule.
- E. Section 01 4523 - Testing and Inspection.
- F. Section 01 2513 - Product Substitution Procedures.
- G. Section 01 7836 - Warranties.

1.03 DEFINITIONS

- A. Definitions used in this Section are not intended to change the meaning of other terms used in the Contract Documents, such as “specialties,” “systems,” “structure,” “finishes,” “accessories,” and other similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry.
 - 1. “Products” are items purchased for incorporation into the Work, whether purchased for the Work or taken from previously purchased stock. The term “product” includes the terms “material” and “equipment” and terms of similar intent.
 - a. “Named Products,” are items identified by the manufacturer’s product name, including make, model number or other designation, shown or listed in the manufacturer’s published product literature, current as of the date of the Contract.

- b. “Foreign Products,” as distinguished from “domestic products,” are items substantially manufactured (50 percent or more of value) outside the United States and its possessions. Products produced or supplied by entities substantially owned (more than 50 percent) by persons who are not citizens of, nor living within, the United States and its possessions are also considered to be foreign products.
2. “Materials,” are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
3. “Equipment,” is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.04 SUBMITTALS

- A. Material list: Prepare a list in tabular form acceptable to ARCHITECT and/or OAR showing proposed products. Include generic names. Include the manufacturer’s name and proprietary names for each item listed.
 1. Coordinate material list with the Construction Schedule and the submittal schedule.
 2. Form: Prepare material list with information on each item tabulated under the following column headings.
 - a. Related Specification Section number.
 - b. Generic name used in Contract Documents.
 - c. Proprietary name, model number, and similar designations.
 - d. Manufacturer’s name and address.
 - e. Supplier’s name and address.
 - f. Installer’s name and address.
 - g. Projected delivery date or time span of delivery period.
 3. Initial Submittal: Within ten days after execution of each subcontract agreement, as set forth in General Conditions Article 6.23, submit three copies of an initial material list to the ARCHITECT with a copy to the

OAR. Provide a written explanation for omissions of data and for known variations from the Contract Documents.

4. ARCHITECT Action: ARCHITECT will respond in writing to OAR within fourteen days and OAR will forward response to CONTRACTOR within sixteen days of receipt of the completed material list. No response outside this period constitutes no objection to listed items but does not constitute a waiver of the requirement that selected items comply with the Contract Documents. ARCHITECT response will include a list of unacceptable item selections, containing a brief explanation of reasons for this action.

1.05 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.
 1. CONTRACTOR is to verify necessary lead times for all materials; however, when specified products are available only from sources that do not, or cannot, produce a quality adequate to complete Work in a timely manner, consult with the ARCHITECT to determine the most important product qualities before proceeding. Qualities may include attributes, such as visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources producing these qualities, to the fullest extent possible.
- B. Compatibility of Options: When the CONTRACTOR is given the option of selecting between two or more products for use in the Work, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
- C. Foreign Product Limitations: Except under one or more of the following conditions, provide domestic products, not foreign products, for inclusion into the Work:
 1. No available domestic product complies with the Contract Documents.
 2. Domestic products that comply with the Contract Documents are available only at prices or terms substantially higher than foreign products that comply with the Contract Documents.
- D. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturers or producer's nameplates or trademarks on exposed surfaces of products that will be exposed in view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
 1. Schedule delivery to minimize long-term storage at the Project site and to prevent overcrowding of Work spaces.
 2. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to the Project site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
 5. Store products at the Project site in a manner that will facilitate inspection and measurement of quantity or counting of units.

6. Store heavy materials away from structures in a manner that will not endanger the structure's supporting construction.
7. Store products subject to damage by the elements above ground, under cover in a weather-tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS

2.01 MATERIAL SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.
 1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other Projects.
- B. Product Selection Procedures: The Contract Documents and governing regulations govern product selection. Procedures governing product selection include the following:
 1. Proprietary Specification Requirements: Where Specifications name only a single material or manufacturer, provide the product indicated. No substitutions will be permitted.
 2. Semi-proprietary Specification Requirements: Where Specifications name two or more products or manufacturers, provide one of the products indicated. No substitutions will be permitted.
 - a. Where Specifications specify products or manufacturers by name, accompanied by the term "or equal" comply with General Conditions Article 6.14 to obtain approval for use of an unnamed product.
 3. Descriptive Specification Requirements: Where Specifications describe a product or assembly, list exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with the Contract Documents.

4. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by the manufacturer for the application indicated.
 - a. Manufacturer's recommendations may be contained in published material literature or by the manufacturer's certification of performance.
5. Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes, or regulations specified.
6. Visual Matching: Where Specifications require matching an established Sample, decision of the ARCHITECT will be final on whether a proposed product matches satisfactorily.
7. Visual Selection: Where specified product requirements include the phrase "... as selected from manufacturer's standard or premium colors, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The ARCHITECT will select the color, pattern, and texture from the product line selected.

PART 3 - EXECUTION

3.01 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located, and aligned with other Work.
- B. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration until Substantial Completion.

END OF SECTION

SECTION 01 2513

PRODUCT PROCEDURES FOR SUBSTITUTION AND “OR EQUAL”

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section includes administrative and procedural requirements for handling requests for substitutions and “or equal” submitted pursuant to Section V. Contract Documents, subsection C.

1.02 RELATED REQUIREMENTS

- A. Section 01 3229: Project Forms.
- B. Section 01 3300: Submittal Procedures.
- C. Section 01 6000: Product Requirements.
- D. Section 01 7700: Contract Closeout.

1.03 APPLICATION

- A. OAR will review CONTRACTOR proposed changes in products or materials required by the Contract Documents.
 - 1. Substitutions: OAR will consider requests for substitution if a product is no longer manufactured or the OAR and ARCHITECT, after a diligent search have verified that product or material is not available to CONTRACTOR. The following are not considered to be valid requests for substitutions:
 - a. Revisions to the Contract Documents requested by OAR or ARCHITECT.
 - b. Specified options of products included in the Contract Documents.
 - c. Substitutions requested on a “or equal” basis.
 - 2. “Or Equal”: OAR will consider requests for “or equal” if submitted within the time indicated in Article 6.14 of the General Conditions.

1.04 SUBMITTALS

- A. Transmit submittals as described in related Sections for each request for substitution or “or equal”.
1. Identify the product to be replaced in each request. Include related Specification Section and Drawing number.
 2. Provide complete documentation denoting compliance with the requirements for substitutions, and the following information, as appropriate.
 - a. A detailed comparison of significant qualities of the proposed substitution with those specified in the Contract Documents. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.
 - b. Product Data, including Drawings, descriptions of products, fabrication, and installation procedures.
 - c. Samples, where applicable or requested.
 - d. CONTRACTOR certification the proposed substitution or “or equal” conforms to requirements of the Contract Documents in every respect and is appropriate for the applications indicated.
 - e. CONTRACTOR waiver of rights to an increase in the Contract Amount, Milestones and/or Contract Time.
 3. If required, OAR and ARCHITECT will request additional information or documentation for evaluation.
 4. ARCHITECT will review requests for substitutions and “or equals” and provide a recommendation to OAR.
 5. If ARCHITECT accepts proposed substitutions or “or equals” OAR will forward submittals to the OWNER’s Maintenance and Operations Technical Unit for review. OAR will notify CONTRACTOR of acceptance or rejection of the substitution.
 6. Where a proposed substitution or “or equal” involves and/or affects more than one Subcontractor, CONTRACTOR shall ensure each Subcontractor cooperates with the other Subcontractor involved to coordinate the Work, provide uniformity and consistency, and assure compatibility of all products.
 7. CONTRACTOR submittal and ARCHITECT review of Shop Drawings, Product Data, material lists or Samples do not constitute an acceptable or valid request for substitutions or “or equals”.

2. PART 2 - PRODUCTS (Not used)

3. PART 3 - EXECUTION

END OF SECTION

SECTION 01 3113

PROJECT COORDINATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section specifies administrative and procedural requirements necessary for coordinating Work operations including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.

1.02. RELATED REQUIREMENTS

- A. Section 01 3213: Construction Schedule.
- B. Section 01 3300: Submittal Procedures.
- C. Section 01 4523: Test and Inspection.
- D. Section 01 4525: Testing, Adjusting, and Balancing for HVAC.
- E. Section 01 7700: Contract Closeout.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

7.01 COORDINATION

- A. CONTRACTOR shall coordinate operations included in various sections of Contract Documents to assure efficient and orderly installation of each part of Work. Coordinate Work operations included under related sections of Contract Documents that depend on each other for proper installation, connection, and operation of Work, including but not limited to:
 - 1. Schedule construction operations in sequence required where installation of one part of Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
 3. Provide provisions to accommodate items scheduled for later installation.
 4. Prepare and administer provisions for coordination drawings.
- B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required in notices, reports, attendance at meetings, and:
1. Prepare similar memoranda for OAR and Separate Work Contract where coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of Work. Such administrative activities include, but are not limited to, following:
1. Preparation of schedules.
 2. Installation, relocation, and removal of temporary facilities.
 3. Delivery and processing of submittals.
 4. Progress meetings.
 5. Project closeout activities.
- D. Conservation: Coordinate Work operations to assure operations are carried out with consideration given to conservation of energy, water, materials, and:
1. Salvage materials and equipment involved in performance of, but not actually incorporated into Work.

7.02 SUBMITTALS

- A. Coordination Drawings: CONTRACTOR shall prepare coordination drawings to coordinate the installation of products and materials fabricated, furnished and installed by separate entities, under different parts of the Contract. CONTRACTOR shall notify OAR and ARCHITECT of all major conflicts in writing in a timely manner so that the design team can respond without construction delays. Coordination drawings shall address the following at a minimum:

1. Limitations in available space for installation or service. CONTRACTOR shall overlay plans of each trade and verify space requirements and conflicts between trades. Minor changes and adjustments that do not affect design intent shall be made by CONTRACTOR and shall be highlighted for ARCHITECT'S review.
 2. Incompatibility between items provided under different trades (such as difference in voltage between equipment specified under Divisions 22 and 23 and electrical power provided under Division 26.)
 3. Inconsistencies between drawings, specifications and codes (between trades and within each trade).
 4. Additional items required for existing facilities construction projects shall be designed and prepared from available as-built drawings that are verified through non-invasive and non-destructive, visual observation only. CONTRACTOR shall field verify actual existing conditions during and upon completion of demolition work and incorporate findings into preparation of co-ordination drawings. Minor changes and adjustments that do not affect design intent shall be made by Sub-Contractor and shall be highlighted for OAR and ARCHITECT'S reviews.
- B. Prepare coordination drawings in CAD with each trade on a separate layer, in specified color and scale. CONTRACTOR and each Subcontractor shall provide and forward reproducible copies and CAD drawing files in the order described here:
1. Structural shop drawings shall indicate location and sizes of columns, beams and other structural members, as well as wall, roof and slab penetrations, and will be provided to mechanical, electrical, low voltage and plumbing Sub-contractors for co-ordination. Structural items shall be indicated using black lines.
 2. HVAC Subcontractor will indicate all ductwork, piping and equipment complete with installation and dimensioned service clearances, duct and pipe sizes, fitting types and sizes, top or bottom of duct and pipe elevations, distances of ducts, pipes and equipment from building reference points and hanger and support locations. Minor changes and adjustments that do not affect design intent shall be made by Subcontractor and shall be highlighted for OAR and ARCHITECT'S reviews. Forward drawings to plumbing Subcontractor for further co- ordination. HVAC items shall be indicated using orange lines.

3. Plumbing Subcontractor will indicate all plumbing lines, and equipment complete with installation and dimensioned service clearances, pipe sizes, fitting types and sizes, top or bottom of pipe elevations, distances of pipes and equipment from building reference points and hanger/support locations Co-ordinate with HVAC Subcontractor. Minor changes and adjustments that do not affect design intent shall be made by Sub- contractor and shall be highlighted for OAR and ARCHITECT'S reviews Upon completion drawings shall be forwarded to Fire Sprinkler Subcontractor for further co-ordination. All Plumbing items shall be indicated using blue lines.
4. Fire sprinkler Subcontractor will indicate fire sprinkler piping and equipment complete with installation and dimensioned service clearances, pipe sizes, fitting types and sizes, top or bottom of pipe elevations, distances of pipes and equipment from building reference points and hanger or support locations. Co-ordinate with Plumbing and HVAC Subcontractors. Minor changes and adjustments that do not affect design intent shall be made by sub-contractors and shall be highlighted for OAR and ARCHITECT'S reviews. Upon completion drawings shall be forwarded to Electrical CONTRACTOR for further co-ordination. Fire sprinkler equipment shall be indicated using red lines.
5. Electrical and Low Voltage Subcontractors will indicate service and feeder conduit runs and other electrical equipment complete, including low voltage with installation and dimensioned service clearances, sizes, top or bottom of conduit and rack elevations, distances of conduits and equipment from building reference points and hanger and support locations. Co-ordinate with Fire Sprinkler, Plumbing and HVAC Subcontractors. Minor changes and adjustments that do not affect design intent shall be made by sub-contractors and shall be highlighted for OAR and ARCHITECT'S reviews. Upon completion drawings shall be forwarded to CONTRACTOR for further co-ordination. Electrical work shall be indicated in dark green lines. Low voltage work shall be indicated in light green lines.
6. CONTRACTOR will be responsible for the overall coordination review. As each coordination drawing is completed, CONTRACTOR will meet with OAR to review and resolve all conflicts on coordination drawings.
7. Coordination meetings will be held in Project field office of CONTRACTOR. CONTRACTOR is required to distribute Shop Drawings, cut sheets and submittals to Subcontractors where appropriate. Reviewed coordination drawings will be maintained in Project field office

of CONTRACTOR. Meeting minutes shall be developed by CONTRACTOR and submitted to OAR within 5 days.

END OF SECTION

SECTION 01 1100
SUMMARY OF WORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. The furnishing of all labor, materials, equipment, services, and incidentals necessary for Work of the **Clark Building Renovations Project (CIP 689)** located at 861 Valley Drive, Hermosa Beach, CA. 90254 as set forth in the Construction Documents which include, but are not limited to, the Drawings, Addenda and Specifications.

1.02 RELATED REQUIREMENTS:

1. Section 01 2300: Alternates (Bid Items).
2. Section 01 3113: Project Coordination.
3. Section 01 3229: Project Forms.
4. Section 01 3213: Construction Schedule.
5. Section 01 4525: Testing, Adjusting, and Balancing for HVAC.
6. Section 01 5000: Construction Facilities and Temporary Controls.
7. Section 01 7123: Field Engineering.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 USE OF PREMISES

- A. CONTRACTOR shall coordinate Work of all trades, Subcontractors, utility service providers, with OWNER and/or Separate Work Contract. CONTRACTOR shall sequence, coordinate, and perform the Work to impose minimum hardship on the operation and use of the existing facilities and/or Project site. CONTRACTOR shall install all necessary protection for existing improvements, Project site, property, and

new Work against dust, dirt, weather, damage, vandalism, and maintain and relocate all protection to accommodate progression of the Work.

- B. CONTRACTOR shall confine entrance and exiting to the Project site and/or facilities to routes designated by the OAR.
- C. Within existing facilities, OWNER will remove portable equipment, furniture, and supplies from Work areas prior to the start of Work. CONTRACTOR shall cover and protect remaining items in areas of the Work.
- D. CONTRACTOR is advised school may be in session during performance of the Work. CONTRACTOR shall utilize all available means to prevent generation of unnecessary noise and maintain noise levels to a minimum. When required by the OAR, CONTRACTOR shall immediately discontinue noise-generating activities and/or provide alternative methods to minimize noise generation. CONTRACTOR shall install and maintain air compressors, tractors, cranes, hoists, vehicles, and other internal combustion engine equipment with mufflers, including unloading cycle of compressors. CONTRACTOR shall discontinue operation of equipment producing objectionable noise as required by the OAR.
- E. CONTRACTOR shall furnish, install, and maintain adequate supports, shoring, and bracing to preserve structural integrity and prevent collapse of existing improvements and/or Work modified and/or altered as part of the Work.
- F. CONTRACTOR shall secure building entrances, exits, and Work areas with locking devices as required by the OAR.
- G. CONTRACTOR assumes custody and control of OWNER property, both fixed and portable, remaining in existing facilities vacated during the Work.
- H. CONTRACTOR shall cover and protect surfaces of rooms and spaces in existing facilities turned over for the Work, including OWNER property remaining within as required to prevent soiling or damage from dust, dirt, water, and/or fumes. CONTRACTOR shall protect areas adjacent to the Work in a similar manner. Prior to OWNER occupancy, CONTRACTOR shall clean all surfaces including OWNER property.
- I. CONTRACTOR shall not use or allow anyone other than OWNER employees to use facility telephones and/or other equipment, except in an emergency. CONTRACTOR shall reimburse OWNER for telephone toll charges originating from the facility except those arising from emergencies or use by OWNER employees.
- J. CONTRACTOR shall protect all surfaces, coverings, materials, and finished Work from damage. Mobile equipment shall be provided with pneumatic tires.

- K. CONTRACTOR is advised OWNER will award Separate Work Contracts at this Project site.
- L. CONTRACTOR shall not permit the use of portable and/or fixed radio's or other types of sound producing devices including walkmans and similar devices.

3.02 PROPERTY INVENTORY

- A. Property, OWNER intends to remove; will be removed by OWNER before a room or space is vacated for the Work. Before performing Work in each room or space, OAR and CONTRACTOR shall prepare a detailed initial written inventory of OWNER property remaining within, including equipment and telephone instruments and the condition thereof. OAR and CONTRACTOR shall retain a signed copy of the inventory dated and signed by both parties. Prior to subsequent OWNER occupancy of each such room or space, OAR and CONTRACTOR shall perform a final inventory of OWNER property and all discrepancies between the initial inventory and final inventory shall be the responsibility of CONTRACTOR.

3.03 FURNITURE, FIXTURES AND EQUIPMENT (MATERIALS) OWNER FURNISHED CONTRACTOR INSTALLED (OFCI)

- A. Certain materials identified in the Contract Documents as OWNER Furnished CONTRACTOR Installed, OFCI, will be delivered to the Project site by the OWNER.
- B. If designated in the Contract Documents to be OWNER furnished CONTRACTOR installed, (OFCI), CONTRACTOR shall unload, store, uncrate, assemble, install, and connect OWNER supplied materials.
- C. One-Hundred and Twenty days before the date the CONTRACTOR needs to have the OFCI materials on site, CONTRACTOR shall notify OWNER of the scheduled date for needed OFCI materials. Upon delivery to Project site, CONTRACTOR shall store OFCI materials inside rooms and/or protected spaces and will be responsible for security of OFCI materials until Substantial Completion. OAR will sign receipt or bill of lading as applicable.
- D. CONTRACTOR shall, within ten days after delivery, uncrate and/or unpack OFCI materials in presence of OWNER who shall inspect delivered items. OWNER shall prepare an inspection report listing damaged or missing parts and accessories. OWNER shall transmit one copy of the report to CONTRACTOR. OWNER will procure and/or replace missing and or damaged OFCI materials, as indicated in inspection report.

- E. CONTRACTOR shall install OFCI materials in the locations and orientation as indicated in the Contract Documents. CONTRACTOR shall verify exact locations with OAR before final installation of OFCI materials.
- F. If required, OAR will furnish setting and or placement drawings for OFCI materials.
- G. CONTRACTOR shall install OFCI materials by proper means and methods to ensure an installation as recommended by the manufacturer. CONTRACTOR shall furnish and install all necessary fasteners and required blocking to properly install OFCI materials.
- H. CONTRACTOR shall install OFCI materials with manufacturer recommended fasteners for the type of construction to which the OFCI materials are being fastened and/or anchored.
- I. CONTRACTOR shall provide final connections of any electrical, signal, gas, water, waste, venting and/or similar items to OFCI materials. CONTRACTOR shall, prior to final connection, verify the operating characteristics of OFCI materials are consistent with the designated supply.

3.04 FURNITURE, FIXTURES AND EQUIPMENT (Materials) - OWNER furnished, OWNER installed (OFOI)

- A. Certain materials are identified in the Contract Documents as OWNER Furnished, OWNER Installed (OFOI)
- B. On dates and during times designated by OWNER, CONTRACTOR shall provide clear off-loading, receiving, protected storage, and OWNER'S dumpster space areas for the use of OWNER or OWNER'S third party OFOI installation contractors. At such times, CONTRACTOR shall also make clear routes and access available to all rooms and spaces to receive OFOI materials.
- C. On dates and during times designated by OWNER, CONTRACTOR shall provide access to the elevators for use of OWNER or OWNER'S third party OFOI installation contractors.
- D. CONTRACTOR shall cooperate fully with OWNER or OWNER'S third part OFOI installation contractors.
- E. CONTRACTOR may be requested by OWNER to provide supplemental labor and equipment to support OFOI activities. Such requests must be submitted in accordance with the change order clauses of Contract.

- F. Immediately prior to mobilization of OWNER or OWNER'S third party OFOI installation contractors, OWNER shall document the condition of the Work in areas to be utilized for OFOI activities.
- G. CONTRACTOR shall not be responsible for damage caused by OWNER or OWNER'S forces. OWNER shall document the condition of the Work and report to CONTRACTOR any damage in areas utilized for OFOI activities.

END OF SECTION

SECTION 01 7123
FIELD ENGINEERING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Layout of the work
2. Verification of work
 - a. OWNER reserves the right to verify any work that INSPECTOR deems necessary.
 - b. Other sections that require Surveyor to verify or measure installed work and related item. Surveyor shall perform such verifications or measurements at CONTRACTOR'S expense. CONTRACTOR shall furnish a certification, signed by both Surveyor and CONTRACTOR, to INSPECTOR.

B. Related Requirements:

1. Section 01 1100 - Summary of Work.
2. Section 01 3113 - Project Coordination.
3. Section 01 3213 - Construction Schedule.
4. Section 01 3300 - Submittal Procedures.
5. Section 01 7700 - Contract Closeout.

1.02 SURVEY CONTROLS

- A. Vertical Control shall use same benchmark used in the preparation of topographic survey. When Work consists of both on-site and off-site and benchmarks differ, an equation shall be indicated on Drawings.
- B. Horizontal control for existing structures shall be the property line.

1.03 LAYOUT OF WORK

- A. All work related to staking shall be by a Land Surveyor, or Civil engineer, registered with the State of California to perform land surveying and employed by CONTRACTOR.
- B. Before commencement of Work, surveyor shall locate all reference points and benchmarks to be used for vertical and horizontal control.
- C. Surveyor shall lay out entire Work, set grades, lines, levels, control points, elevations, grids and positions.

1.04 RECORD DOCUMENTS

- A. Maintain complete and accurate log of all control and survey documentation as work progresses.
- B. Record, by coordinates, all utilities onsite with top of pipe elevations, at major grade and alignment changes, rim, grate or top of curb and flow line elevations of all drainage structures and sewer manholes.
- C. Indicate reference and control points on record drawings. The basis of elevation shall be one of the established benchmarks.
- D. Upon Substantial Completion, obtain and pay for reproducible plans. Deliver plans to OAR. Clearly indicate all differences between original drawings and completed work within specified tolerances.

1.05 SUBMITTALS

- A. Surveyor: Shall submit name, address and license number to OWNER, including any changes as they occur.
- B. Field notes: Upon request by OAR, submit copies of cut sheets, coordinate plots, data collector printouts, marked-up construction staking plans and other documentation as available to verify accuracy of field engineering work during and at completion of project. Submittals to OWNER must be signed and sealed by Surveyor and counter-signed by CONTRACTOR
- C. Statement of Compliance: CONTRACTOR shall submit a statement of certification signed and sealed by Surveyor, counter-signed by CONTRACTOR indicating compliance with grades and alignment of construction plans at rough grade, fine grade and top of rock stages. INSPECTOR shall approve survey submittals for each stage of construction prior to proceeding with work
- D. Upon Substantial Completion, CONTRACTOR shall obtain and pay for reproducible survey drawings (or "As Built").

- E. Completed record drawings shall be signed and certified as correct and within specified tolerances by licensed surveyor. Originals and two sets of blueprints shall be submitted to OWNER.

PART 2-PRODUCTS – NOT USED

PART 3-EXECUTION

3.01 PREPARATION

- A. Pre-mark areas of excavation in accordance with the requirements of “Dig-Alert”. Request locators 2 days before commencing excavation.
- B. Before commencing Work, establish all horizontal and vertical reference points used in Contract Documents according to existing field conditions.
- C. Preserve established reference lines and benchmarks.
- D. Differentiate school and city datum as applicable.
- E. Relocate bench marks that may interfere with Work.
- F. Reset and re-establish reference marks damaged or lost during construction.

3.02 SURVEY REQUIREMENTS GENERAL

- A. Establish a minimum of two permanent horizontal and vertical control points on Project site, remote from construction area, referenced to data established by control points.
- B. Indicate reference points, relative to benchmark elevation, on record drawings.
- C. Provide grade stakes and elevations to construct over excavation and re-compaction, rough and final grades, paved areas, curbs, gutters, sidewalks, building pads, landscaped areas, and other areas as required.
- D. Calculate and layout proposed finished elevations and intermediate controls as required to provide smooth transitions between spot elevations indicated on Drawings.
- E. Provide stakes and elevations for grading, fill, and topsoil placement.
- F. Provide adequate horizontal and vertical control to locate utility lines, including but not limited to, storm, sewers, water mains, gas, electric and signal and provide vertical control in proportion to the slope of the line as required for accurate construction. Dry utilities will be based upon adequate horizontal and vertical control layout. Prior to

trench closure, survey and record invert and flow line elevations. Survey and record top of curb and flow line elevations on finished concrete or asphaltic concrete (AC) surfaces at key locations such as beginning-of-curve (BC), end-of-curve (EC), grade breaks, corners or angle points in sufficient number to demonstrate the Work complies with the intent of the Contract Documents.

- G. Provide horizontal and vertical control for batter boards for drainage, utility, and other on-site structures as required.
- H. Furnish building corner offsets as required to adequately locate building pads. Provide cut and fill stakes within the building pad perimeter adequate to control both over excavation and re-compaction and the final sub-grade elevation of the building pad.
- I. Submit a certification signed by the surveyor confirming the elevations and locations of improvements are in conformance with the Contract Documents. The statement shall include survey notes for the finish floor and building pad, showing the actual measured elevations on the completed sub-grade, recorded to the nearest 0.01 of a foot. Building pad tolerance will be plus or minus 0.1 of a foot.
- J. Establish a minimum of two permanent horizontal and vertical control points on Project site, remote from building area, referenced to data established by survey control points.
- K. Mark boundaries for rights-of-way dedications and easements for utilities prior to making location of buildings and utilities.
- L. Layout all lines, elevations and measurements needed for construction or installation of buildings, grading, paving utilities according to the following:
 - 1. Identify site boundary, property lines.
 - 2. Provide working benchmarks.
 - 3. Set stakes for Bottom of Excavated Plane (B.E.P.).
 - 4. Set gridlines, radii, working points etcetera, for foundation.
 - 5. Set and verify building pad elevations.
 - 6. Set finish floor elevations.
 - 7. Stake location and elevations for exterior ramps and stairs.
 - 8. Set gridlines, radii, working points, etcetera, for all floors of multi-story buildings.

9. Set storm drain and sanitary sewer inverts and other utilities as needed at 5- foot off-set from building lines.
10. For new facilities, establish permanent onsite Benchmark with 2-inch diameter brass disk. Location of Benchmark to be determined by OWNER.

3.03 SURVEY REQUIREMENTS FOR GRADING

- A. Provide grade stakes and elevations as follows:
 1. Removal limits (cut lines).
 2. Rough grade staking: 60-foot maximum grid plus additional stakes at grade changes and pertinent locations. Flag all grade changes including ridges, flow lines and grade breaks.
 3. Fine grade for top of dirt: 30-foot maximum grid plus additional stakes at grade changes and pertinent locations. Flag all grade changes including ridges, flow lines and grade breaks.
 4. Verify fine grade for top of rock: 30-foot maximum grid plus additional stakes at grade changes and pertinent locations. Flag all grade changes including ridges, flow lines and grade breaks.
 5. Finish grade marks on all buildings, structures and at pertinent locations
 6. Finish grades and offsets for all concrete work, utilities, landscape areas, and structures.
 7. Provide controls and baselines for playground striping.
 8. Offsite improvements: set grades and provide grade sheets as required by local authorities.
- B. Provide a minimum of two permanent horizontal and vertical control points onsite, remote from building area, referenced to data established by survey control points.

3.04 SURVEY REQUIREMENTS FOR UTILITIES

- A. Locate “wet” utility lines and provide vertical control proportionate to slope of line as required for accurate construction. “Dry” utilities shall have adequate horizontal and vertical control layout supplied by others.
- B. Prior to back-filling trench, survey and record invert and flow line elevations. Survey and record top of curb and flow line elevations on finished surfaces at key locations

(such as Back of Curbs, grade breaks, corners or angle points) in sufficient number to demonstrate Work complies with intent of Contract Documents.

- C. Provide horizontal and vertical control for batter boards for drainage, utility, and other on-site structures as required.
 - 1. Set grades for vaults one inch higher than adjacent surrounding design grades, unless noted otherwise.
- D. Leave all trenches open until required inspection is completed.

3.05 SURVEY REQUIREMENTS FOR STRUCTURES

- A. Furnish building corner offsets as required to adequately locate building pads. Provide cut and fill stakes within building pad perimeter adequate to control both over excavation and re-compaction and final sub-grade elevation of building pad.
- B. Submit a certification signed by surveyor confirming elevations and locations of improvements are in conformance with Contract Documents. Statement shall include survey notes for finish floor and building pad, showing actual measured elevations on completed sub-grade, recorded to nearest 0.01 of a foot. Building pad tolerance will be plus or minus 0.1 of a foot.

END OF SECTION

SECTION 01 3213
CONSTRUCTION SCHEDULE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Required procedures, preparation, submittals, reviews, updates, and revisions to the cost/schedule integrated construction schedule. The purpose of this section is to:
 - 1. Ensure adequate planning and execution of the Work by CONTRACTOR.
 - 2. Establish a standard against which satisfactory completion of the Project can be measured by OWNER.
 - 3. Assist CONTRACTOR and OAR in monitoring progress.
 - 4. Aid in assessing the impact of any changes to the Contract.
 - 5. Provide justification for progress payments.

1.02 RELATED REQUIREMENTS

- A. Section 01 1100: Summary of Work.
- B. Section 01 2300: Alternates (Bid Items).
- C. Section 01 2973: Schedule of Values.
- D. Section 01 2976: Progress Payment Procedures.
- E. Section 01 3113: Project Coordination.
- F. Section 01 3300: Submittal Procedures.
- G. Section 01 4523: Testing and Inspection.
- H. Section 01 4525: Testing, Adjusting, and Balancing for HVAC.
- I. Section 01 5000: Construction Facilities and Temporary Controls.
- J. Section 01 7700: Contract Closeout.
- K. Section 01 7836: Warranties.

PART 2 – PRODUCT

2.01 SCHEDULING SOFTWARE

- A. CONTRACTOR shall utilize an OWNER approved Scheduling Software (P6) to employ the Critical Path Method (CPM) in the development and maintenance of the construction schedule. The scheduling software shall be capable of being resource loaded with manpower, costs and materials. It shall also be capable of generating time-scaled logic diagrams.

- B. All schedule calculation rules, auto cost rules and resource calculation rules shall be in a format acceptable to OAR. When schedule calculations are performed, the “Retained Logic” setting shall be used. CONTRACTOR shall use the zero “Decimal Places” setting.

PART 3 – EXECUTION

3.01 SUBMITTALS

- A. CONTRACTOR shall retain a construction scheduler to work in enough capacity to perform all of the requirements outlined in this Section. Contractor will cooperate with OAR and shall be available on site for monitoring, maintaining and updating schedules in a timely manner.
- B. CONTRACTOR shall submit two color originals and three copies of all bar charts, reports and/or other required schedule data as outlined in this Section. CONTRACTOR shall electronically deliver the schedule file in its original format at the time of submittal.
- C. CONTRACTOR shall attend a pre-construction scheduling conference with OAR. Contractor shall then develop and submit the Preliminary Construction Schedule within 14 days after Notice of Award. .
- D. CONTRACTOR shall submit the Proposed Baseline Schedule no later than thirty days from the Notice to Proceed.
- E. CONTRACTOR shall submit the Monthly Schedule Updates, Four-Week Rolling Schedules, and Recovery Schedules as required.

3.02 PRELIMINARY CONSTRUCTION SCHEDULE

- A. The purpose of the cost-loaded Preliminary Construction Schedule is to provide a interim mechanism in which to measure performance on individual activities and to validate the CONTRACTOR’S monthly Application for Payment on work performed (starting with month one) during the first three months of the job until the complete Baseline Schedule is approved by the OAR.
- B. CONTRACTOR shall develop and submit a cost loaded Preliminary Construction Schedule as required by this Section. It shall be submitted in computer generated network format and shall be organized by Activity Codes representing the CONTRACTOR’S intended sequencing of the Work. The Preliminary Construction Schedule shall include activities for the first 90 calendar days following the NTP such as mobilization, preparation of submittals, specified review periods, procurement items, fabrication items, milestones, and detailed construction activities.
- C. Upon OAR’S acceptance of the Preliminary Construction Schedule, CONTRACTOR shall update the accepted Preliminary Construction Schedule each month (beginning with month 1) and submit these updates until CONTRACTOR’S Baseline Schedule is fully developed and accepted. Since updates to Preliminary

Construction Schedule are the basis for payment to CONTRACTOR during the first three-month period, submittal and acceptance of such updates shall be a condition precedent to making of monthly payment, as referenced in General Conditions.

- D. Provide a written narrative describing CONTRACTOR'S approach to mobilization, procurement, and construction during the first 90 calendar days including crew sizes, equipment and material delivery, site access, submittals, and permits.
- E. If the project is of a short duration and it would be more beneficial for the CONTRACTOR to forego the preliminary 90 day schedule, then upon CONTRACTOR request and OAR written Approval, the CONTRACTOR may go straight into development of the Baseline Schedule for the entire project. This will need to be implemented expeditiously in order to not impede the processing of the monthly pay applications. Approval of the Baseline schedule and first monthly update is precedent of the monthly pay application.

3.03 SCHEDULE OF VALUES

- A. CONTRACTOR shall cost load activities in the Construction Baseline Schedule and allocate costs to the cost accounts of all activities. The cost accounts shall match the CSI sections listed in the Table of Contents of the Specifications. The format shall be coordinated with Specification Section 01 2973 (Schedule of Values) and Specification Section 01 2976 (Progress Payment Procedures).
- B. Submit a computer generated report from the Construction Baseline Schedule. The report shall contain the following data for each activity: Cost Account Number (by CSI section), Cost Account Description, Cost Account Budget, Cost to Date, Cost this Period, and Cost to complete. Total costs shall be organized and totaled by CSI section. This report shall be the source of the data CONTRACTOR reports on the Schedule of Values.
- C. The cost loading associated with the activities shall be based on CONTRACTOR estimates of costs that CONTRACTOR will incur performing the specific activities. If OAR determines that the costs are front loaded and/or the distribution of costs is unreasonable, CONTRACTOR shall revise accordingly and resubmit the Schedule of Values within five (5) days for OAR review.

3.04 BASELINE SCHEDULE CPM NETWORK

- A. No later than twenty one days from the Notice to Proceed CONTRACTOR shall submit a detailed Proposed Baseline Schedule that covers the entire duration of the Project. This schedule shall convey CONTRACTOR'S plan for organizing, managing, and executing the Work.
 - 1. The Proposed Baseline Schedule shall include activity descriptions, sequencing, logic relationships, duration estimates, cost loading by CSI section in accordance The Proposed Baseline Schedule shall include all Milestones, as well as all activities required to achieve timely completion of the Milestones.

2. The Proposed Baseline Schedule shall include activities for: all construction activities, the NTP, Milestones, submittals, coordination drawings, re-submittals, procurement of materials and equipment, manufacturing, fabrication & delivery, owner furnished contractor installed items (OFCI), access restrictions, work restrictions, phased occupancy, testing, start-up, and contract closeout activities. The Proposed Baseline Schedule shall allow a period for OAR and ARCHITECT to review each submittal and additional time for OWNER reviews and deferred submittal reviews.
 3. The Proposed Baseline Schedule shall include start and completion dates for: temporary facilities, construction of mock-ups, prototypes, samples, punch list, OWNER interfaces and furnishing of items, separate work contracts, regulatory agency approvals, and permits required for performance of the Work.
 4. The Proposed Baseline Schedule shall allow for all foreseeable factors and risks which affect performance of the Work. Include allowances for weather conditions, applicable laws, transportation, traffic, air quality, noise, or any other applicable regulatory requirements.
 5. CONTRACTOR shall not use any float suppression techniques such as preferential sequencing or logic, special hidden lag time between activities or milestones, float absorption activities, or unjustifiable over-estimating of activity durations in preparing the Proposed Baseline Schedule. Finish Milestones should be constrained to a "Finish on or before" constraint. No "Zero Free Float" constraints, No "Early" Constraints, and No "Mandatory Finish" constraints shall be utilized.
 6. The Proposed Baseline Schedule shall include activity durations based on the crew sizes and equipment utilization that CONTRACTOR will maintain during the Project. Non-construction activities such as procurement, delivery, or submittal activities are exempted. CONTRACTOR will need to perform their due-diligence to make sure that the activity man-power loading and activity durations are directly integrated.
 7. CONTRACTOR shall include with the Proposed Baseline Schedule a written narrative report sufficiently comprehensive to explain the rationale behind CONTRACTOR'S approach to the Work including but not limited to: activity durations, manpower flow, average crew sizes (by trade), equipment requirements, anticipated production rates, constraints, holidays and other non-work days, potential problem areas, permits, coordination with regulatory authorities, utilities, separate work contracts and other parties, and long lead delivery items requiring more than thirty days from the date of order to delivery to the Project site.
- B. At the OAR'S request, furnish a detailed written explanation of CONTRACTOR'S basis for specific durations, logic, phasing, or other information. Such an explanation shall include CONTRACTOR'S rationale for selecting the number of

crews, crew composition, number of shifts per day, number of hours in a shift, number of work days per week, construction equipment, and similar factors.

- C. The Proposed Baseline Schedule activities shall contain the following data:
1. Activity ID numbers shall consist of a built-in intelligence scheme. Following OAR acceptance of the Baseline Schedule, Activity ID numbers shall not be changed.
 2. Activity Descriptions shall provide adequate information that readily identifies each activity, work scope, and location.
 3. At a minimum, activity codes shall be applied to each activity. This is at the activity level and is different than WBS coding structure.
 4. Cost accounts (in CSI Master Format) and Resource accounts shall be applied to each activity. They shall include lump sum costs, and man-hours/man-days (where applicable).
- D. At OAR'S request, furnish a written explanation for each lead or lag relationship and each constrained date. Unjustifiable leads, lags, and constraints will result in OAR'S rejection of the Proposed Baseline Schedule.
- E. Calendar Identification: In the scheduling software, identify all activities that will require overtime shifts, double shifts, and work on weekends or holidays. Identify non-work days and holidays in the schedule calendar. No holiday or non work-day restrictions are permitted on this calendar. The Calendar coding shall be transferable and compatible with the OWNER calendars as to not distort any start/finish dates and "total float" values upon schedule re-calculation.
- F. Activity Codes: As a minimum, the Activity Codes shown in the Table 1 below shall be assigned to each activity.

Table 1

Name	Length	Description
TYPE	2	Type of activity (for example: mobilization, submittals, procurement/fabrication, construction, milestones, etcetera.)
AREA	2	Area or Building (for example: Bldg A, Building B, Courtyard, Athletic Fields, Street Work, etcetera.)
STAG	2	Stage (for example: Foundations, Superstructure, Exterior, Interior, Roof, Floor Number etcetera.)
SBST	2	Substage (a specific area within a stage such as: main electrical room, kitchen, room number, etcetera.)
RESP	7	Responsible Party (subcontractor and/or trade)
DIV	2	CSI Division
SPEC	5	CSI Specification Section number

1. OAR may require additional coding of activities. The mandatory activity code requirements listed in Table 1 are not to be construed as setting limits on CONTRACTOR'S management and coordination responsibilities, but

are intended to guide CONTRACTOR in the administration of its contractual responsibilities.

- G. Milestones: are designated dates in which Work or portions thereof are required to start and complete in accordance with the Contract Documents.
1. Where the term completion or similar terms are used in regards to a Milestone, it shall be construed to mean all portions of the Work in the indicated phase, area, and zone are complete and acceptable to OAR. Where the term start or similar terms are used in the designation of a Milestone, it shall be construed to mean a portion of the Work in the indicated phase, area, or zone is required to be commenced.
 2. A Proposed Baseline Schedule extending beyond the Milestones or Contract Time will not be acceptable.
 3. Finish Milestones shall be constrained with "Finish on or before" type constraints.
 4. A Proposed Baseline Schedule indicating Work completed in less time than the Milestones and/or Contract Time will not be acceptable. Rather, CONTRACTOR shall show any unused contract time as float available to the project.
 5. Milestones shall be placed on a calendar with seven days per week. No Holiday or non work-day restrictions are permitted on this calendar.
- H. The Critical Path shall be clearly indicated on all schedules submitted. An activity is defined as critical when it is shown to be on the longest path from beginning to end.
- I. CONTRACTOR shall allow for inclement weather in the Proposed Baseline Schedule by incorporating an activity titled "Rain Day Impact Allowance" as the last activity prior to the Substantial Completion Milestone. No other activities may be concurrent with it. The duration of the Rain Day Impact Allowance activity will be based on Table #2 below, and will be calculated from the Notice to Proceed until the original date of Substantial Completion.
1. When inclement weather at the Project site impacts Critical Path activities, CONTRACTOR may provide the OAR with a written request for a weather

impact day describing the inclement weather delay on the Critical Path activities. The inclement weather delay must be clearly indicated by a 70 percent decrease in the field labor workforce hours on Critical Path activities on the day in question as indicated by CONTRACTOR'S Daily reports from the day in question and the scheduled work days prior to the day in question. Upon OAR'S independent confirmation of the amount of rainfall and impact, OAR will authorize CONTRACTOR to reduce the duration of the Rain Day Impact Allowance by one day.

2. Inclement weather on non-scheduled workdays shall not be granted as weather impact days. If CONTRACTOR asks to work a specific weekend or holiday and gives OAR advanced, written notification of critical path work to be performed and a substantial amount of precipitation occurs that prevents the work from being performed, then that day can be claimed as a weather impact day. If the effects of inclement weather from a non-scheduled work day carry forward to a scheduled work day and impacts the Critical Path as noted above, then the scheduled work day will be considered impacted by weather. Any unused rain day allowance at the end of the project will be shown as available float to the Substantial Completion Milestone. Excusable, non-compensable time extensions will be granted for inclement weather to Substantial Completion milestone only after the weather impact area affecting the critical path work has exhausted the allotted cumulative Rain Day Impact Allowance. On projects that have multiple phases with defined start & finish dates, the cumulative rain impact allowance may be split up (pro-rated) into their designated phases upon OAR Approval.

J. Cost loaded Activities:

1. Each activity included in the Proposed Baseline Schedule shall be assigned the cost CONTRACTOR estimates it will incur performing that activity. Each activity's assigned cost will be inclusive of overhead and profit so CONTRACTOR'S total overhead and profit is distributed over all activities on a pro rata basis. The sum of the costs assigned to activities shall equal the total contract value. No activity costs shall be assigned to manufacturing or delivery activities unless approved by OAR. If OAR finds that the costs are front loaded and the distribution of costs is unreasonable, CONTRACTOR shall re-distribute the costs and resubmit the revised Schedule of Values within five days for OAR backcheck.
2. CONTRACTOR shall cost load activities in the Proposed Baseline Schedule and allocate costs to related resource/cost accounts associated with each activity. The cost accounts shall match the CSI sections listed in the Table of Contents of the Specifications. The format shall be coordinated with Specification Section 01 2973 (Schedule of Values), and Specification Section 01 2976 (Progress Payment Procedures). All cost-loaded activities shall roll-up to their designated CSI sections and shall be the basis for the

data reported in the Schedule of Values (Section 01 2973) and Progress Payment Procedures (Section 01 2976).

3. Submit computer generated reports using the scheduling software which will be the basis for the approved Schedule of Values. The reports shall contain the following data for each activity: Cost/Resource Account Number (by CSI section), Cost/Resource Account Description, Cost/Resource Account Budget, Cost to Date, Cost this Period, and Cost at Completion. Total Costs shall be organized and totaled by CSI section.
- K. CONTRACTOR shall submit computer generated reports and plots with the Proposed Baseline Schedule submittal package. Format shall display the following columns: Activity ID, Activity Description, Original Duration, Remaining Duration, Percent Complete, Early Start, Early Finish, Late Start, Late Finish, and Total Float. Unless otherwise noted, bar charts and reports shall be on 8 ½ by 11 paper and bound.
1. Color Bar charts shall be generated separately for:
 - a. Milestones only.
 - b. All Activities sorted by Early Start date and organized by Project, Area, Stage, and Substage. (The network shall be organized to show continuous flow of all activities from left to right). CONTRACTOR is reminded that during the monthly schedule update process, even the activities that have already been completed need to be shown in this “all activities” bar chart report.
 - c. Activities sorted by Responsibility.
 - d. Summary level of all activities sorted by craft/trade and area.
 - e. Critical Path (Longest Path). The network shall be organized to show continuous flow of all critical activities on the longest path from left to right (sorted by early start).
 2. Reports:
 - a. Total Float sorted low to high.
 - b. Predecessors and Successors sorted by Activity ID.
 - a. same graph. The Total Costs shall be based on the Early Dates option.

man-power loading is realistic and adequate based on material /labor cost estimates.
 3. Provide a written narrative as requested by the AOR.
 4. Electronic data: Provide an electronic file in its original format of the Schedule.
- L. OAR will notify CONTRACTOR of any adjustments that are required for the Proposed Baseline Schedule to be accepted. CONTRACTOR shall perform any

required adjustments to the Proposed Baseline Schedule and resubmit it for acceptance certifying in writing that all information contained therein complies with the Contract Documents. OAR will review the Proposed Baseline Schedule for accuracy, reasonableness, and conformance with the Contract Documents and shall provide comments within ten days of receipt. Within five days after receiving OAR comments, CONTRACTOR shall both incorporate changes to address OAR concerns and resubmit the Proposed Baseline Schedule for OAR backcheck. This process will continue until the Proposed Baseline Schedule is accepted as the Baseline Schedule. Once accepted by OAR, the Baseline Schedule will be the basis upon which CONTRACTOR shall prepare updates that record and report actual performance and progress. The accepted Baseline Schedule and subsequent Monthly Updates shall be the basis for consideration and analysis of requests for time extensions and CONTRACTOR progress payments.

- M. OAR acceptance of the Baseline Schedule or CONTRACTOR'S failure to identify or include an element of the Contract, shall not release CONTRACTOR'S obligation to complete all required Work in accordance with the Contract Documents.

3.05 REQUIREMENTS FOR MONTHLY/WEEKLY SCHEDULE UPDATING

- A. Once the Baseline Schedule is accepted by OAR, CONTRACTOR shall copy the Approved Baseline file to a new name, status the activities with actual as-built data through the end of the month & submit Monthly Schedule Updates beginning with month No. 1. The current month's schedule update cannot be accepted until the previous Monthly Schedule Update has been accepted by OAR. Each Monthly Schedule Update shall be submitted con-currently with the Monthly Pay Application no later than the fifth day of the succeeding month in accordance with Article 14 of the General Conditions.
- B. Monthly Schedule Update Format.
 1. Initially, the contractor shall status a current Monthly Schedule Update with actual Work progress only. No logic ties shall be modified. Status all Actual Start and Finish dates, adjust Remaining Durations where needed, and update Percent Completion of cost and resource loaded activities. No activity Original Durations or Logic shall be changed unless authorized by OAR. No new activities shall be added (except for the addition of new activities for every re-submittal and re-review required) or unless authorized by the OAR.
 2. Once the schedule is status updated, CONTRACTOR shall print (and submit with Monthly Schedule Update) a report of "out-of-sequence" logic that results from the updating process. CONTRACTOR shall then correct all "out-of-sequence" logic to reflect CONTRACTOR'S actual Work sequence. Prior to submission of the Monthly Schedule Update, CONTRACTOR shall review and validate that all remaining activities along with their schedule relationships are still accurate based on the actual work flow in the field. If CONTRACTOR chooses to modify logic or add

activities (other than out-of-sequence corrections), for OAR Review & Approval. CONTRACTOR shall also submit a comparison report between the previous monthly schedule update and the current monthly update that will document the over-all changes.

3. During construction, CONTRACTOR may desire to break down specific activities into greater detail. If greater detail is necessary, then CONTRACTOR shall identify expanded activities such that the Baseline Schedule activities that the expanded activities originated from are readily apparent. CONTRACTOR shall not allow the aggregate duration of the expanded activities to exceed the duration assigned to the Baseline Schedule activity unless permitted by OAR in writing.
4. Autocost rules and calculation rules shall link Remaining Duration and Percent Complete.
5. The Data Date for the Monthly Schedule Updates shall be the first day of the succeeding month. At a minimum, three days prior to the submission of the Monthly Schedule Update, CONTRACTOR shall meet in person with OAR to present the proposed Percentages of Completion and Actual Start and Actual Finish dates. Once percentages of completion and actual dates have been agreed to, they shall be the basis of the Monthly Schedule Update.
6. Written Narrative Report: CONTRACTOR shall include a written report to explain the Monthly Schedule Update. The narrative shall, at a minimum include the following headings with appropriate discussions of each topic:
 - a. Introduction.
 - b. A Summary of Work which was on-going (This Pay Period).
 - c. Problem Areas and Proposed Solutions.
 - d. Critical Path.
 - e. Current and Anticipated Delays.
 - f. Coordination of Work with Others.
 - g. Milestone Status.
 - h. Revisions: the standard schedule comparison report that compares the current update to the previous update shall be submitted to help document any variances/changes. However this comparison report will not be accepted by OWNER in lieu of the above written narrative requirements outline above.
7. In updating the Schedule, CONTRACTOR shall not modify Activity ID numbers, schedule calculation rules/criteria, or the Activity Coding Structure required.

8. Submit bar charts, reports, a cost flow histogram, man-power histogram, written narrative, electronic data, and plots in accordance with Article 3.04-L.
 9. Submit a cost-loaded report (progressed monthly) produced from the scheduling software that displays all of the activities organized by the CSI section cost/resource accounts. This report shall be in compliance with Article 3.04-K, Section 01 2973 (Schedule of Values) and Section 01 2976 (Progress Payment Procedures).
- C. Four-Week Rolling Schedule: At each Weekly Progress Meeting, CONTRACTOR shall present a Four-Week Schedule in Bar Chart format. It shall show one (1) week of actual and three (3) weeks of forecasted progress. The Four-Week Rolling Schedule shall be used as a basis for discussing progress and work planned during the three (3) weeks.
1. The Four-Week Rolling Schedule shall be based on the most recent OAR Accepted Monthly Schedule Update. It shall include weekly updates to all construction, submittal, fabrication and procurement, and separate work contract activities. CONTRACTOR shall ensure that it accurately reflects the current progress of the Work.
 2. CONTRACTOR shall discuss at the weekly Progress meeting the actual dates and any variances to critical or near critical activities.
 3. Upon request by OAR, CONTRACTOR shall provide the Four-Week Rolling Schedule in electronic format.
 4. If the Four-Week Rolling Schedule indicates activities are behind schedule, CONTRACTOR shall provide a Recovery Schedule.
 5. If the CONTRACTOR chooses to provide a Four-Week Rolling Schedule in a greater level of detail (by trade/subcontractor) outside of the monthly contractual P6 schedule database, then upon CONTRACTOR REQUEST and OAR written approval, the CONTRACTOR may proceed as long as the detailed activities roll-up to the contractual P6 monthly schedule updates. These detailed activities will need to be linked to the overall Substantial Completion date as to properly forecast whether the project is ahead or behind schedule during the weekly Progress Meetings. The Four-Week Rolling Schedule must accurately reflect the work that is going on during the current week and must accurately reflect what will happen in the next three weeks.

3.06 RECOVERY SCHEDULES

- A. If a Monthly Schedule Update indicates negative float greater than ten (10) days on a critical path as result of events not predicated by Articles 10 and 12 of the General Conditions CONTRACTOR shall prepare a Proposed Recovery Schedule demonstrating CONTRACTOR'S plan to regain the time lost. The Recovery Schedule shall be submitted either in advance of or concurrent with the Monthly

Schedule Update and CONTRACTOR progress request. Both the Monthly Schedule Update and the Proposed Recovery Schedule shall be based on the same percentages of completion and actual dates accepted by OAR.

- B. The Proposed Recovery Schedule shall be based on a copy of the Monthly Schedule Update for the calendar month during which the negative float first appears.
- C. The Proposed Recovery Schedule shall include a written narrative that identifies the causes of the negative float on the critical path and provides CONTRACTOR'S proposed corrective action to ensure timely completion of all Milestones and the Substantial Completion Date. CONTRACTOR'S corrective actions shall include but are not limited to increasing concurrent operations, increasing labor, adding multiple shifts in a 24-hour period, and adding overtime.
- D. During any period of time when CONTRACTOR is found to be behind schedule by OAR, the Monthly Schedule Update described above shall become a weekly requirement (at no additional cost to OWNER) to provide a greater degree of focus on the timely completion of the Work. These Updates shall be submitted to OAR every Monday morning. When CONTRACTOR is deemed by OAR to be back on schedule, CONTRACTOR may revert to submitting the schedule monthly.
- E. CONTRACTOR'S progress payment may not be processed until OAR accepts the Proposed Recovery Schedule. Following such an acceptance, the Proposed Recovery Schedule will be known as the Recovery Schedule and future Work will be performed by CONTRACTOR in accordance with it.

3.07 FRAGNETS AND TIME EXTENSION REQUESTS

- A. Float is not for exclusive use or benefit of either OWNER or CONTRACTOR but is an expiring resource available to both parties on a non-discriminatory basis. If required to meet specified Milestones, either party may utilize float. Adjustments to Milestones or Contract Time will only be authorized by Change Order and only to the extent the claimed adjustments exceed total float along the most critical path of the current Monthly Schedule Update in effect at the time of the claimed adjustments. The claimed adjustments to the Milestones and/or Contract Time must also cause the Substantial Completion Date to exceed that currently indicated in the Monthly Schedule Update. No time extensions will be granted nor delay damages paid under contract until all available float is used and the CONTRACTOR obtains a Time Extension Request approval from the OAR. CONTRACTOR claimed adjustments to an existing negative float path will not receive consideration until the activity with the highest negative float is driven even further negative.
 - 1. Claimed adjustments to the Milestones or Contract Time will be administered in conjunction with those set forth in the General Conditions.
- B. Pursuant to the float sharing requirements of this Section, the use of float suppression techniques such as preferential sequencing or logic, special lead or lag logic restraints, and extended activity times or durations are prohibited. The use of float time disclosed or implied by the use of alternate float suppression techniques

shall be proportionally shared to benefit OWNER and CONTRACTOR. The use of any technique solely for the purpose of suppressing float will result in OWNER rejection of the submitted Monthly Schedule Update.

- C. In the event CONTRACTOR believes the Project has suffered an adverse impact, CONTRACTOR may prepare a Time Extension Request by submitting a Schedule Fragnet and a written narrative outlining the detail of the impact. A Schedule Fragnet must demonstrate a critical path delay. Such a delay must adversely impact the Substantial Completion Date for CONTRACTOR to receive a time extension. To demonstrate such an impact successfully, CONTRACTOR shall prepare a Schedule Fragnet based on a copy of OWNER accepted Monthly Schedule Update for the calendar month during which the adverse impact occurred. This “copy” of the OWNER accepted Monthly Schedule Update shall however first be updated (by OWNER and CONTRACTOR jointly) with both Percentages of Completion and Actual Dates up to the day the delay commenced. This process will provide the “pre-delay” project status. Once OWNER and CONTRACTOR have agreed to the “pre-delay” project status, CONTRACTOR should make a copy of this “pre-delay” schedule and this copy is to be the starting point for CONTRACTOR’S Schedule Fragnet development. OWNER will evaluate the activities, logic, durations, etcetera. The Fragnet shall also include CONTRACTOR-caused delays that affect the critical or near critical path in the network and should be accounted for in the Time Impact Analysis if overlapped at any point in time with OWNER-caused delay. If rain impact days were granted between the Start and Finish of OWNER-caused delay period, they should be accounted for in the Time Impact Analysis as well. Provided OWNER determines such an impact occurred, CONTRACTOR may be due a time extension equal to the number of proportioned days of variance/delay that resulted to the Substantial Completion Date.
- D. Activities added into a Schedule Fragnet to demonstrate the impact of adverse event shall be assigned a unique activity code. The Schedule shall be organized by this unique activity code.
- E. The Schedule Fragnet shall incorporate logic that accurately ties reflective of the adverse event to pre-event predecessor activities and post event successor activities.
- F. It is crucial for the Fragnet to be submitted within the same month of discovery so it can be resolved during the monthly schedule update review. The notice shall be transmitted to OAR.
- G. If OWNER accepts CONTRACTOR’S Schedule Fragnet and an extension is granted, a Change Order will be prepared. OWNER will advise what change order number the time extension will become. When CONTRACTOR receives this Change Order number, all the activities added to the Schedule Fragnet shall be given Activity Identification Numbers that corresponds with the Change Order number. CONTRACTOR shall cost load and resource-load the activities if required by OWNER. If resource loading is required, the resource loading shall include a breakdown of labor, material, and equipment quantities.

- H. If OWNER rejects CONTRACTOR'S Schedule Fragnet in part based on improper forecast logic or activity tasks then it shall be revised accordingly to conform to OWNER'S review comments and resubmitted. If the forecast logic and activity tasks cannot be agreed to then the pre-delay schedule outlined in Article 3.07-C shall be compared to the actual as-built data in the succeeding month of the encountering issue, event, condition, circumstance, and/or cause. The variance to the project between the pre-delay and post delay schedules shall be discussed in CONTRACTOR'S written narrative and proportioned between the different parties involved in the delay.

3.08 FAILURE TO COMPLY WITH REQUIREMENTS

- A. At any time during the project if CONTRACTOR fails to comply with the specified requirements, OWNER reserves the right to engage independent estimating and scheduling consultants to fulfill these requirements. Upon notice to CONTRACTOR, OWNER shall assess against CONTRACTOR, incurred costs for these additional services.
- B. In such an event, OWNER will require, and CONTRACTOR shall participate and provide requested information to ensure the resulting Milestones Schedule accurately reflects CONTRACTOR's plan to execute the Work in compliance with the Contract Documents. If it becomes necessary for OWNER to recommend logic or duration revisions as a result of CONTRACTOR failure to furnish acceptable data, and if CONTRACTOR has objections to the recommendations, CONTRACTOR shall provide notice to OWNER within three days and CONTRACTOR shall provide an acceptable alternate plan. If CONTRACTOR fails to so note any objections and provide an acceptable alternate plan, or if CONTRACTOR implements the recommendations of OWNER without so noting any objections, CONTRACTOR will be deemed to have waived all objections and concurred with the recommended logic/duration revisions provided by ARCHITECT and/or OWNER.
- C. Submittal of any Monthly Schedule Updates are subject to review and acceptance by OWNER. OWNER retains the right to withhold progress payments in whole or part until CONTRACTOR submits a Monthly Schedule Update acceptable to OWNER. If a Monthly Schedule Update is "Rejected" due to the OWNER not receiving a satisfactory schedule that accurately reflects the on-going work activities, the OWNER will mandate a separate meeting with the CONTRACTOR and approved Scheduler to remedy the non-conformance.

3.10 CONTRACTOR RESPONSIBILITY

- A. Nothing in this Section shall be construed to be a usurpation of CONTRACTOR authority, responsibility, and obligation to plan and schedule Work as CONTRACTOR deems necessary, subject to all other requirements of the Contract Documents.

- B. CONTRACTOR shall involve the subcontractors, manufacturers, and suppliers in the development and periodic updating of the schedule.

3.11 RECORD DOCUMENTS / FINAL AS-BUILT SCHEDULE

- A. Prior to Contract Completion of the Work, CONTRACTOR shall submit a final as-built schedule, and a time-scaled network diagram reflecting the actual dates of all activities. This shall be submitted prior to the final application of payment and prior to the request to release retention.

END OF SECTION

SECTION 01 9113

GENERAL COMMISSIONING REQUIREMENTS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This Section defines the Contractor's responsibilities with respect to Commissioning. The Contractor shall include this scope in the bid. This includes administrative and procedural requirements as well as a detailed execution of Commissioning. This Section supplements Section 01 4523 – Testing and Inspection, Section -01 4525 Testing, Adjusting, and Balancing for HVAC, as well as the Divisions 22 - Plumbing, Division 23 – Mechanical, and Division 26 – Electrical sections which specify testing procedures. For projects that have Specification Section 01 4516 or 01 4519, Contractor Construction Quality Control, the Commissioning schedule and activities as defined in the approved Commissioning Plan shall be incorporated by Contractor into the Construction Quality Control (CQC) plan. The Commissioning Services Provider will be part of the Owner's Quality Assurance (QA) Team and participate in the review and execution of the Project Construction Quality Control (CQC) plan, along with the Contractor, Owner's Authorized Representative (OAR), Project Inspector (PI), and Architect of Record (AOR).

1.02 DEFINITIONS

- A. Commissioning (Cx): A systematic process which verifies that the building systems perform according to the Owner's Design Intent/Basis of Design (ODI/BOD). Commissioning includes system documentation, equipment startup, control system calibration, Testing, Adjusting and Balancing (TAB) verification, performance testing, and training.
- B. Commissioning Services Provider (CxSP): A City of Hermosa Beach appointed entity that plans and coordinates all activities which implement Commissioning as outlined by the Owner's Design Intent/Basis of Design (ODI/BOD). The CxSP has overall responsibility for planning and coordinating Commissioning. Commissioning activities that take place during construction shall be based on the Contractor's construction schedule.
- C. Commissioning Plan (CxP): A contract document that identifies the project Commissioning goals, Owner's Design Intent/Basis of Design, commissioning milestones, coordination requirements, and project specific Pre-functional Equipment Checklists and Functional Performance Test Checklists. The CxP shall be incorporated by Contractor into the Construction Quality Control Plan.

- D. Pre-functional Equipment Checklist (PEC): A form for each piece of equipment referenced in '1.08 SYSTEMS TO BE COMMISSIONED' that must be completed by the Contractor as a prerequisite to the equipment's Functional Performance Test (FPT). Sample checklists and PEC forms are included in the CxP. The checklists and forms are completed by the Contractor and verified by the CxSP.
- E. Functional Performance Test (FPT): A documented test designed by the Commissioning Services Provider to verify the dynamic functioning and operation of equipment and systems with the goal of verifying that the Owners' Design Intent, Owner's Project Requirements, and Basis of Design (BOD) are met. Sample testing requirements and forms are included in the CxP. Test procedures are performed by the Contractor and witnessed by the INSPECTOR and CxSP.
- F. Acceptance - A formal action, taken by a person with appropriate authorization, to declare that some aspect of the project meets defined requirements – thereby permitting subsequent activities to proceed.
- G. Checklists - Documents that are developed and used during all phases of commissioning to verify that the Owner's intent is being achieved. This includes checklists for general verification, testing, training, and other specific requirements. Various checklists are prepared by the CxSP and the contractor to document completion of testing and/or commissioning of equipment and systems.
- I. Coordination Drawings - Drawings showing the work of all trades to illustrate that equipment can be installed in the space allocated without compromising equipment function or access for maintenance and replacement. These drawings graphically illustrate and dimension manufacturers' recommended maintenance clearances.
- K. Control system – A component of an environmental, HVAC, electrical, lighting, or energy management system for the reporting, monitoring and/or issuing of commands to and/or from field devices.
- L. Data logging -The monitoring and recording of flows, currents, status, pressures, etc., of equipment using stand-alone data recorders separate from the installed control system or the trending capabilities of those control systems.
- M. Deficiency - A condition that is not in compliance with the contract documents relative to the installation or function of a component, piece of equipment, or system.
- N. Factory Testing - Testing of equipment at the factory or on-site by factory personnel with, or without, an owner's representative present.
- O. Issues Log - A formal and ongoing record of problems or concerns – and their resolution – that have been raised by members of the commissioning team during the course of commissioning.

- P. Seasonal Performance Tests - Tests that are performed when weather conditions are comparable to the design conditions based or the design conditions can be simulated.
- R. Simulated Condition - Condition that is created for the purpose of testing the response of a system (for example: raising/lowering the set point of a thermostat to see the response in a VAV box).
- S. Startup - The initial starting or activating of dynamic equipment.
- T. Systems Manual - A system-focused composite document that includes the operation manual, maintenance manual, manufacturer's technical diagrams and additional information of use to the owner during facility occupancy and operation.
- U. Test Procedure - A written protocol that defines methods, procedures, personnel, and expected outcomes for tests conducted on components, equipment, assemblies, systems, and interfaces among systems. The test procedures are specified in the Commissioning Plan and Technical Specifications sections of the contract documents and the CxP.
- V. Training Plan - A written document that details the expectations, schedule, budget, and deliverables of commissioning activities related to the training of facility operating and maintenance personnel, users, and occupants.
- X. Verification - The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Owner's Design Intent/Basis of Design. Verification testing is performed per the prescribed test procedure(s) by the contractor and witnessed by the INSPECTOR and CxSP.
- Y, Trending – The analysis of system performance gathered over a period of time by a building management system or other electronic data gathering equipment.

1.03 RELATED REQUIREMENTS

- A. Section 00 7300 – Supplementary Conditions.
- B. Section 01 2513 – Product Substitution Procedures.
- C. Section 01 3113 – Project Coordination.
- D. Section 01 3119 – Project Meetings.
- E. Section 01 3213 – Construction Schedule.
- F. Section 01 3300 - Submittal Procedures.
- G. Section 01 4516 or 01 4519 – Contractor Construction Quality Control.

- H. Section 01 4523 - Testing and Inspection.
- I. Section 01 4525 - Testing, Adjusting, and Balancing for HVAC.
- J. Section 01 5000 – Construction Facilities and Temporary Controls.
- K. Section 01 7700 – Contract Close-Out.
- L. Section 01 7836 – Warranties.
- M. Section 01 7900 – Staff Demonstration and Training.
- N. Section 23 0800 – HVAC Systems Commissioning.
- O. Section 23 0813 – Environmental Controls and Energy Management Systems Commissioning.
- P. Section 26 0800 – Electrical Systems Commissioning.

1.04 REFERENCES

- A. Guideline 1.1-2007 -- HVAC&R Technical Requirements for the Commissioning Process.
- B. Associated Air Balance Council Commissioning Guidelines.
- C. CHPS Best Practices Manual, Volume V: Commissioning.
- D. Sample Commissioning Plan Documentation.

1.05 COORDINATION

- A. Items listed below require coordination between the Contractor, OAR, INSPECTOR, and CxSP. Details regarding each item are provided through out this Section and/or Sections 01 7900, 23 0800, 23 0813 and 26 0800.
 - 1. Cx Schedule and Meeting Venue.
 - 2. Commissioning Meeting Attendance.
 - 3. Completion of Pre-functional Equipment Checklists (PEC).
 - 4. Functional Performance Testing (FPT).
 - 5. Operations & Maintenance Manual Submittal and Training.
 - 6. Documentation of Pre-functional Equipment Checklists (PEC) & Functional Performance Testing (FPT) Inspections.

- B. For projects using Specification Section 01 4516 or 01 4519, the CxSP shall coordinate with the Contractor's designated Quality Control representative, OAR and INSPECTOR.

1.06 SUBMITTALS

- A. Submittal documentation required for the commissioning work will be identified by the CxSP and integrated into the normal submittal process and protocol of the construction team. At minimum, the CxSP's documentation request will identify the manufacturer and model number, the manufacturer's printed installation and detailed startup procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details of owner contracted tests. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted. All such documentation will be included by subcontractors in their O&M manual submittals.
- B. The CxSP will review and recommend acceptance or any required revision to the OAR for all submittals related to the commissioned equipment for conformance with the contract documents as they relate to commissioning, performance of the equipment, and their adequacy of test procedures. This review is intended primarily to aid in the development of performance procedures and only secondarily to verify compliance with equipment specifications. The CxSP will notify the OAR of items missing or areas that are not in conformance with contract documents and which require resubmission. Submittal of O&M manual documentation does not constitute compliance. The CxSP will review all such document submittals and recommend to OAR their acceptance or any required revisions.
- C. Submittal documentation specified in Specifications 23 0800, 23 0813 and 26 0800.

1.07 CONTRACTOR RESPONSIBILITIES

- A. The general responsibilities of Contractor and Subcontractors in commissioning are defined in this section. The specific responsibilities are in the Division 22 and 23 and Division 26 Technical Specifications. All parties shall:
 - 1. Follow the Commissioning Plan.
 - 2. Attend commissioning meetings.
- B. Contractor, its design team, subcontractors and vendors shall assign representatives with expertise and authority to act on their behalf and schedule them to participate in and perform required commissioning activities including, but not limited to, providing all tools, or the use of tools, to start, check-out and test equipment and systems, except for specified testing with portable data recorders which shall be supplied and installed by the CxSP. Contractor and subcontractors shall:

1. Facilitate coordination of Commissioning.
2. Incorporate Commissioning activities (the CxP) into the Project Schedule.
3. Coordinate and direct Commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.
4. Participate in up to three meetings specifically for Commissioning-related items as scheduled by the OAR.
5. Review and accept construction checklists developed by the CxSP.
6. Provide information required to perform commissioning tasks, including O&M materials, contractor startup and checkout lists.
7. No later than 60 days prior to startup of the first piece of major equipment, meet with the CxSP and OAR to finalize the detailed commissioning procedures and schedule.
8. Before startup, provide detailed startup procedures including current control sequences and interlocks to comply with the detailed functional test plans.
9. Provide one additional copy of all submittals required in Section 01 3300 for all systems being commissioned for review of compliance with commissioning needs by the CxSP.
10. Develop and coordinate a startup and initial systems checkout plan with subcontractors and ensure that all subcontractors and vendors execute their commissioning responsibilities according to the contract documents.
11. Review TAB execution plan.
12. Oversee sufficient testing of the control system before TAB is executed.
13. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
14. Coordinate retesting as necessary until satisfactory performance is achieved
15. Complete checklists as work is completed and provide to OAR on a weekly basis.
16. Review equipment warranties to ensure that the owner's responsibilities to keep warranties in force are clearly defined.

17. Oversee and coordinate the training of the owner's personnel.
18. Review and approve the preparation of the O&M manuals including clarifying and updating of original sequences of operation to as-built/as-tested conditions.
19. Coordinate development of a systems manual

1.08 SYSTEMS TO BE COMMISSIONED

- A. Systems to be commissioned for this project include, but are not limited to, those for which Specifications are included in Contract Documents and as listed in:
 1. Section 23 0800, Article 1.06 - Equipment And Systems To Be Commissioned.
 2. Section 23 0813.
 3. Section 26 0800, Paragraph 3.01.B.

PART 2 – PRODUCTS

1.01 TEST EQUIPMENT

- A. Standard testing equipment required to perform startup and initial checkout and required performance testing shall be provided by the contractor for the equipment being tested. This includes, but is not limited to, two-way radios and meters, etc. Testing specified as requiring portable data recorders will be performed with data recorders supplied and installed by the CxSP.
- B. Testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance within the tolerances specified in the specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a current certified calibration to an accuracy of 0.5 degree F and a resolution of plus or minus 0.1 degree F. Pressure sensors shall have an accuracy of plus or minus 2.0 percent of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 – EXECUTION

1.02 MEETINGS

- A. Commissioning Kick-off Meeting: Within 15 days following issuance of Notice-to-Proceed 1 (NTP 1), the OAR will schedule a Construction Quality Control kick-off meeting. The INSPECTOR, Cx team and Contractor Quality Control representative

will be in attendance. CxSP shall prepare and distribute a list of commissioning topics to be placed on the meeting agenda. Attendance at this meeting and participation in the Commissioning topics is mandatory for the following Contractor personnel:

1. Contractor's Quality Control Engineer and Commissioning Representative.
 2. Contractor's Project Scheduling personnel.
 3. Mechanical Subcontractors.
 4. Electrical Subcontractors.
 5. TAB Subcontractor.
 6. Controls Subcontractors.
- B. Other Commissioning Meetings. Other Cx meetings will routinely be scheduled and generally be conducted in conjunction with regularly scheduled site meetings as the Construction progresses. The Commissioning portion of meetings will cover upcoming implementation and coordination of the CxP, deficiency resolution, and planning issues with particular subcontractors.

3.02 STARTUP, CONSTRUCTION CHECKLISTS, AND INITIAL CHECKOUT

- A. The following procedures apply to all equipment/systems to be commissioned:
1. General: Contractor shall use PECs to verify that the equipment and systems are fully connected and operational. PECs for a given system must be successfully completed and accepted prior to startup and formal performance testing of equipment or subsystems of the given system.
 2. Startup and Checkout Plan: The CxSP will assist the project commissioning team members responsible for startup of any equipment. The primary role of the CxSP in this process is to ensure that there is written documentation and that each of the manufacturer-recommended procedures has been completed. The CxSP shall provide all the required pre-functional checklists and forms to be completed by Contractor in the CxP. The CxSP will ensure that the INSPECTOR and/or District Special Inspectors are informed as to the planned and scheduled startup and checkout procedures.
 - a. Sample Pre-Functional checklists are provided as an attachment to the CxP. These checklists indicate required procedures to be executed prior to equipment startup.
 - b. Contractor shall determine which trade is responsible for executing and documenting each of the line item tasks and transmit the checklists to

the responsible subcontractors. Each form may have more than one trade responsible for its execution.

- c. The contractor/subcontractor responsible for the purchase and/or installation of the equipment shall develop a comprehensive startup plan (with assistance from the CxSP) by combining the manufacturer's detailed startup and checkout procedures and the pre-functional checklists.
 - d. The contractor/subcontractor shall submit the full startup plan to the CxSP for review and approval.
 - e. INSPECTOR will review and accept, based on CxSP recommendation, the procedures and the documentation format for reporting. The CxSP will return the procedures and the documentation format to Contractor through the OAR.
 - f. Contractor shall transmit the full startup plan to the subcontractors for their review and use.
- B. Sensor and Actuator Calibration. All field-installed temperature, relative humidity, CO, CO₂, refrigerant, O₂, and/or pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated. Verify that all locations are appropriate and away from causes of erratic operation. Submit to the CxSP through the OAR the calibration methods and results. All test instruments shall have had a current certified calibration record. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated. Contractor to field verify all installed sensors.
1. Sensor Calibration Methods:
 - a. All Sensors: Verify that all sensor locations are appropriate and away from causes of erratic operation. Verify that sensors with shielded cable are grounded only at one end. For sensor pairs that are used to determine a temperature or pressure difference, make sure they are reading within 0.2 degrees F of each other for temperature and within a tolerance equal to 2 percent of the reading of each other for pressure.
 - b. Sensors Without Transmitters: Standard Application. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, install offset in BAS, calibrate or replace sensor.
 - c. Sensors With Transmitters: Standard Application. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify

that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, install offset in BAS and calibrate or replace sensor.

2. Tolerances, Standard Applications:

<u>Sensor</u>	<u>Required Tolerance (+/-)</u>
Cooling coil, chilled and condenser water temps	0.4F
AHU wet bulb or dew point	2.0F
Hot water coil and boiler water temp	1.5F
Outside air, space air, duct air temps	0.4F
Watt-hour, voltage & amperage	1 percent of design
Pressures, air, water and gas	3 percent of design
Flow rates, air, water	10 percent of design
Flow rates, water Relative humidity	4 percent of design
Combustion flue temps	5.0F
Oxygen or CO ₂ monitor	0.1 percent pts
CO monitor	0.01 percent pts
Natural gas and oil flow rate	1 percent of design
Barometric pressure	0.1 inch of Hg

3. Valve and Damper Stroke Setup and Check EMS Readout: For all valve and damper actuator positions checked, verify the actual position against the BAS readout. Set pumps or fans to normal operating mode. With the command valve and damper closed, visually verify that the command valve or damper is closed and adjust output zero signal as required. With the command valve or damper open, visually verify that the position is full open and adjust output signal as required. Set command valve or damper to a few intermediate positions. If actual valve or damper position doesn't reasonably correspond, repair or replace actuator.
4. Closure for heating coil valves (NO): Set heating set point 20 degrees F above room temperature. Visually observe valve open. Set heating set point to 20 degrees F below room temperature. Visually observe the valve close. Restore to normal.

5. Closure for cooling coil valves (NC): Set cooling set point 20 degrees F above room temperature. Visually observe the valve close. Set cooling set point to 20°F below room temperature. Visually observe valve open. Restore to normal.

C. Execution of Construction Checklists and Startup:

1. Four weeks prior to the scheduled startup, Contractor shall coordinate startup and checkout with the INSPECTOR and CxSP. The execution and approval of the PECs, startup, and checkout shall be directed and performed by Contractor, subcontractor or vendor. Signatures are required of the applicable subcontractors for verification of completion of their work.
2. The INSPECTOR shall observe, as a minimum, the procedures performed for each piece of primary equipment, unless there are multiple units; in which case a sampling strategy may be used. The CxSP shall observe all testing.
3. For lower-level components of equipment, (e.g., sensors, controllers), the CxSP shall observe a sampling of the startup procedures.
4. Pre-functional checklist documentation, identified in the CxP, is to be used by the sub-contractor to document that equipment is ready for startup.
5. The subcontractors and vendors shall execute startup and provide the CxSP, through the OAR, with a signed and dated copy of the completed startup and construction checklists.
6. Only individuals of the contractor or sub-contractor (technicians, engineers, manufacturer's representatives/vendors, supervisors, etc.) who have direct knowledge and have witnessed that a line item task on the construction checklist was actually performed shall check off that item.

D. Deficiencies, Non-Conformance, and Approval in Checklists and Startup (Issues Log):

1. The contractor shall ensure that the subcontractors clearly list any outstanding items of the initial startup and construction checklist procedures that were not completed successfully, on an attached sheet. The form and any outstanding deficiencies shall be provided, through the INSPECTOR, to the CxSP within two days of test completion.
2. The CxSP will review the report and issue either a non-compliance report or acceptance form, through the INSPECTOR, to Contractor. The installing subcontractors or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, shall notify the INSPECTOR as soon as outstanding items have been corrected, and resubmit an updated startup report with a Statement of Correction on the original non-compliance

report. When satisfactorily completed, the CxSP will recommend approval of the execution of the checklists and startup of each system.

3. Items left incomplete, which later cause deficiencies or delays during performance testing, may result in assessments to Contractor. Refer to Paragraph 3.05, herein, for details.

3.03 GENERAL REQUIREMENTS FOR TESTING

- A. Complete the following at least two weeks prior to Functional Performance Testing:
 1. Arrange for Commissioning observations to be performed by the CxSP.
 2. Completion and acceptance of the Start-up Plan by the CxSP.
 3. Correction of deficiencies identified during start-up.
 4. Recording of pretest set points.

3.04 FUNCTIONAL PERFORMANCE TESTING (FTP)

- A. Undertake functional testing after the testing requirements listed in Paragraph 3.02 are completed.
- B. Equipment: Refer to Part 2 of this Section for test equipment requirements.
- C. Perform FPT under the observation of the CxSP who will verify the results of the functional test procedures documented by Contractor.
- D. Perform all specified tests according to approved testing procedures / plan.
 1. Verify and test performance using actual conditions whenever possible.
 2. Simulate conditions when it is not practical to test under actual conditions or when required seasonal testing conditions are not present. The procedure to be used shall be submitted to the OAR for INSPECTOR and CxSP review and acceptance at least one week before simulated testing is to occur. After test, return settings to normal operating conditions.
 3. Alter set points when simulating conditions is not practical and when written approval to do so is received from OAR.
 4. Override sensor values with a signal generator when actual or simulated conditions and altering set points are not practical. Do not use the sensor to act as the signal generator to simulate conditions or override values.

- E. Functional Performance Testing (FPT) Documentation: This Section specifies the general description of the minimum Divisions 22, 23 and 26 Functional Performance Testing documentation requirements that the Contractor shall provide. The CxSP will develop testing procedures in accordance to the requirements of this Section and incorporate into the Cx Plan that Contractor must follow and document. The testing documentation must include the following information:
1. Test number.
 2. Date and time of the test.
 3. Indication of whether the record is for a first test or retest following correction of a problem or issue.
 4. Identification of the system, subsystem, assembly, or equipment.
 5. Conditions under which the test was conducted, including (as applicable) ambient conditions, set points, override conditions, and status and operating conditions that impact the results of the test.
 6. Expected performance of the systems and assemblies at each step of the test.
 7. Narrative description of observed performance of the system, equipment, or assembly.
 8. Notation to indicate whether the observed performance at each step meets the expected results.
 9. Issue number, if any, generated as the result of the test.
 10. Dated signatures of the person performing the test and a witness.
- F. The CxSP and INSPECTOR will review and OAR, if applicable, accept functional testing results. Deficiencies found during testing shall be submitted to the OAR and, if required, based on the recommendation of INSPECTOR, by the OAR, corrected by the Contractor and retested. Where there is a dispute over a deficiency, OAR, based on the recommendation of ARCHITECT and INSPECTOR, shall be the final authority.
- G. Problem Solving: The burden of responsibility to solve, correct and retest problems is with the Contractor and the design team with OAR, based on the recommendations of the ARCHITECT, CxSP and INSPECTOR, having final responsibility for acceptance of the Work.
- H. Substantial Completion: All testing, retesting, and acceptance of Functional Performance Testing shall be completed prior to issuing the Certificate of Substantial Completion. FPT may be conducted following building occupancy; however, all

associated and reasonable additional costs incurred by the CxSP shall be assessed against Contractor Retention or Withhold funds.

- I. Deficiencies in the Cx Plan Functional Performance Test Checklist: If there is any Functional Performance Test Checklist missing for any particular piece of equipment, the Contractor shall inform the CxSP and ask for an updated Functional Performance Test Checklist.

3.05 RETESTING

- A. Retesting shall be required when a specific Pre-functional Checklist or Start-up test item, reported to have been successfully completed by Contractor or determined during functional testing to be faulty or incomplete, is identified.
- B. Contractor shall be provided one retest opportunity at no additional cost when Contractor can make corrections within two hours of identification of the need to retest. Costs for retesting beyond one retest, or when Contractor cannot make corrections within two hours of identification of the need to retest, will be assessed against Contractor funds if OAR determines, based upon the recommendation of the INSPECTOR and CxSP, that the Contractor is responsible for the deficiency. These costs shall include all reasonable expenses incurred by the CxSP.
- C. For a deficiency identified during functional testing, but not included in the approved Start-up Plan, OAR will direct retesting of the equipment with no costs assessed against Contractor for this initial retesting. Costs for retesting, when Contractor cannot effect corrections within two hours of identification of the need to retest, will be assessed against Contractor funds if OAR determines, based upon the recommendation of the INSPECTOR and CxSP, that the Contractor is responsible for the deficiency. These costs shall include all reasonable expenses incurred by the CxSP.
- D. Retesting shall not be considered a reason for a claim of delay or for a time extension by the Contractor.

3.06 DEFERRED TESTING

- A. Unforeseen Deferred Tests: Checks or tests not completed due to the incomplete Work, required occupancy conditions, or other conditions may be delayed upon approval of the OAR based upon the recommendation of the INSPECTOR and CxSP. These tests may be conducted in the same manner as the seasonal tests.
- B. Seasonal Testing: Complete seasonal testing, when weather or other testing conditions do not emulate the system's design conditions, employing simulated conditions acceptable to OAR based upon the recommendation of the INSPECTOR and CxSP. The OAR will coordinate with Contractor, and CxSP validate, this activity. Tests shall be executed, documented and deficiencies corrected by the Contractor, with the

INSPECTOR and the CxSP witnessing. The Contractor shall make adjustments to the Operations and Maintenance Data, as necessary.

3.07 DOCUMENT REVIEW

- A. General: See paragraph 1.06 for submittal requirements.
- B. Operations and Maintenance Manuals: Refer to Section 01 7900 for specific requirements.

3.08 OPERATOR TRAINING

- A. The CxSP, under the direction of the OAR, coordinates and verifies training completion as shown in Section 01 7900. Forms and procedures are also described in the CxP.

END OF SECTION

SECTION 01 2976
PROGRESS PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES:

- A. This Section specifies administrative and procedural requirements for a certified Application for Payment.
 - 1. Coordinate the certified Schedule of Values and certified Application for Payment with, but not limited to, the Construction Schedule, submittal log, and list of Subcontractors.

1.02 RELATED REQUIREMENTS:

- A. Section 01 2100: Allowances.
- B. Section 01 2300: Alternates (Bid Items).
- C. Section 01 2973: Schedule of Values.
- D. Section 01 3213: Construction Schedule.
- E. Section 01 3229: Project Forms.
- F. Section 01 7700: Contract Closeout.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 APPLICATION FOR PAYMENT

- A. Each certified Application for Payment shall be consistent with previous applications and payments as reviewed by OAR, paid for by OWNER, and:
 - 1. The initial Application for Payment and Final Application for Payment at time of Substantial Completion involve additional requirements.
- B. Payment Application Times: The period of Work covered by each Application for Payment is payment date for each progress payment as specified in the Special Provisions Section 7. The period covered by each Application for Payment is previous month.

- C. Payment Application Forms: Use OWNER provided forms for the Application for Payment.
- D. Application Preparation: Complete every entry on the form. Include execution by a person authorized to sign legal documents on behalf of CONTRACTOR. OAR will return incomplete applications without action.
- E. Transmittal: Submit a minimum of four signed and original copies of each certified Application for Payment to OAR. All copies shall be complete, including releases and similar attachments.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to OAR.
- F. Initial Application for Payment within 60 days of issuance of Notice to Proceed: Administrative actions and submittals, that must precede or coincide with submittal for first certified Application for Payment include, but are not limited to, the following:
 - 1. Certified Schedule of Values.
 - 2. Performance and payment bonds.
 - 3. List of principal suppliers and fabricators.
 - 4. Worker Compensation certificates, if applicable.
 - 5. Auto Insurance, if applicable.
 - 6. Hazardous Material Insurance Certificates, if applicable.
 - 7. Construction Schedule.
 - 8. Submittal Schedule.
 - 9. Emergency Contact List.
 - 10. Copies of authorizations and licenses from governing authorities for performance of Work.
 - 11. Certified Payroll (Submitted directly to Labor Compliance in electronic format as specified by OWNER including hard copy).
 - 12. Storm Water Pollution Prevention Plan (SWPPP).
 - 13. Certification of Compliance with CEQA Mitigations.

- G. Applications for Payment: Administrative actions and submittals that must precede or coincide with submittal of Progress Applications for Payment include, but are not limited to, the following:
1. Certified Payroll (submitted directly to Labor Compliance in electronic format as specified by OWNER including hard copy).
 2. Updated and current Project Record Drawings (as-built).
 3. Monthly Construction Schedule (updated, submitted and approved).
 4. Approved Schedule of Values.
 5. List of Subcontractors (Payments Summary).
 6. Storm Water Pollution Prevention (SWPP) – Site Monitoring Report.
 7. Certification of Compliance with CEQA Mitigations.
- H. Final Application for Payment at Substantial Completion: Following OAR issuance of certificate of Substantial Completion, submit an Application for Payment:
1. Administrative actions, submittals and/or Work that shall precede or coincide with this application include:
 - a. Occupancy permits and similar approvals by authorities having legal jurisdiction over Work.
 - b. Removal of temporary facilities and services.
 - c. Testing, adjusting and balance records.
 - d. Removal of surplus materials, rubbish, and similar elements.
 - e. Meter readings.
 - f. Start-up performance reports.
 - g. OWNER training and orientations.
 - h. Operating and maintenance instruction manuals.
 - i. Preliminary Warranties, guarantees and maintenance agreements.
 - j. Delivery of extra materials, products and or stock.
 - k. Change over information related to OWNER occupancy, use, operation, and maintenance.

- l. Final cleaning.
- m. Ensure that Work is completed.
- n. Advise on shifting insurance coverage.
- o. List of defective Work, recognized as exceptions to certificate of Substantial Completion.
- p. Change of door locks, including keys, to OWNER system.
- q. Certified Payroll (submitted directly to Labor Compliance in electronic format as specified by the OWNER including hard copy).
- r. Certification that all benefit contributions due and owing to appropriate union trusts has been paid by CONTRACTOR and Subcontractors, as specified by the Project Stabilization Agreement (PSA) and Article 6.49 of the General Conditions.
- s. Storm Water Pollution Prevention – Site Monitoring Reports, SWPP revisions, compliance certifications, and Notice of Termination (NOT) (see Section 01 7416).
- t. Certification of Compliance with CEQA Mitigations.
- u. Waivers and releases for CONTRACTOR.

END OF SECTION

SECTION 01 3119
PROJECT MEETINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section specifies administrative and procedural requirements for Project meetings, including but not limited to, the following:
 - 1. Pre-Construction meeting.
 - 2. Pre-installation conferences.
 - 3. Progress meetings.
 - 4. Meetings as required by OAR.

1.02 RELATED REQUIREMENTS

- A. Section 01 3113: Project Coordination.
- B. Section 01 3213: Construction Schedule.
- C. Section 01 3229: Project Forms.
- D. Section 01 3300: Submittal Procedures.

PART 2 – PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 PRE-CONSTRUCTION MEETING

- A. The OAR will schedule a pre-construction meeting before starting the Work, at a time and date determined by OAR. Meeting shall be held at the Project site or another location as determined by OAR. Meeting will be held in order to review responsibilities, procedures, and other administrative requirements contained within the Contract Documents.
- B. Authorized representatives of OWNER, INSPECTOR, ARCHITECT, CONTRACTOR and other parties shall attend the meeting. All participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work.

- C. Agenda items shall include significant items which could affect progress of the Work, including, but not limited to the following:
1. Preliminary Construction Schedule.
 2. Critical work sequencing.
 3. Designation of responsible personnel.
 4. Identification of OAR.
 5. Procedures for processing field decisions.
 6. Request for Proposal.
 7. Request for Clarification.
 8. Construction Directive and Change Order.
 9. Procedures for processing Applications for Payment.
 10. Prevailing wages.
 11. Submittal and review of Shop Drawings, Product Data, material lists, and Samples.
 12. Preparation of project record documents.
 13. Use of the Project site and/or premises.
 14. Parking availability.
 15. Office, work, and storage areas.
 16. Equipment deliveries and priorities.
 17. Safety procedures.
 18. First Aid.
 19. Security.
 20. Housekeeping.
 21. Working hours.
 22. Contract Compliance Officer.
 23. Insurance Services including OCIP.

24. Environmental Health and Safety.
 25. Substantial Completion, Administrative Closeout and Contract Completion requirements and procedures.
 26. Procedures for Mandatory Dispute and Claim Resolution.
 27. Storm Water Pollution Prevention Plan (SWPPP).
- D. OAR shall prepare and issue meeting minutes to attendees and interested parties no later than five calendar days after the meeting date.

3.02 PRE-INSTALLATION CONFERENCES

- A. CONTRACTOR shall coordinate and conduct pre-installation conferences at the Project site as required by related Sections of the Contract Documents.
- B. CONTRACTOR, manufacturers, and fabricators involved in or affected by the installation and its coordination or integration with other preceding and/or subsequent installations of Work shall attend the meeting. CONTRACTOR shall advise OAR, INSPECTOR, and ARCHITECT of scheduled meeting dates in order to secure their attendance.
1. CONTRACTOR shall review the progress of construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related Construction Directives and Change Orders.
 - d. Purchases.
 - e. Deliveries.
 - f. Shop Drawings, Product Data, and quality-control samples.
 - g. Review of mockups.
 - h. Possible conflicts.
 - i. Compatibility problems.
 - j. Time schedules.
 - k. Weather limitations.

- l. Manufacturer's recommendations.
 - m. Warranty requirements.
 - n. Compatibility of materials.
 - o. Acceptability of substrates.
 - p. Temporary facilities.
 - q. Space and access limitations.
 - r. Governing regulations.
 - s. Safety.
 - t. Inspecting and testing requirements.
 - u. Required performance results.
 - v. Recording requirements.
 - w. Protection.
2. CONTRACTOR shall record significant discussions and directives received from each conference. CONTRACTOR shall, within three (3) calendar days after the meeting date, distribute the minutes of the meeting to all concerned parties, including but not limited to, OAR, INSPECTOR, and ARCHITECT.

3.03 PROGRESS MEETINGS

- A. Progress meetings will be held at the Project site at regular intervals, typically weekly, as determined by the OAR.
- B. In addition to representatives of CONTRACTOR, OWNER, and ARCHITECT, each Subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of the Work shall, if requested by OAR, be represented at these meetings. All participants at the conference shall be familiar with the Project and authorized to conclude all matters relating to the Work.
- C. Failure of CONTRACTOR to be so represented at any progress meeting which is held at a mutually agreed time or for which a written notice is given, shall not relieve CONTRACTOR from abiding by any and all OAR determinations or directives issued at such meeting.

D. OAR will review and correct or approve minutes of the previous progress meeting and will review other significant items affecting progress. Topics for discussion as appropriate to the status of the Project include but are not limited to:

1. Interface requirements.
2. Construction Schedule.
3. Sequence and coordination.
4. Status of submittals / RFCs.
5. Deliveries.
6. Off-site fabrication.
7. Access.
8. Site utilization.
9. Temporary Construction Facilities and Controls.
10. Hours of work.
11. Hazards and risks.
12. Housekeeping.
13. Quality of materials, fabrication, and execution.
14. Unforeseen conditions.
15. Testing and Inspection.
16. Defective Work.
17. Construction Directive.
18. Request for Proposal.
19. Change Order Proposals and Change Orders.
20. Documentation of information for payment requests.
21. Application for Payment.
22. Other items as required or as brought forth..

- 23. Initial Notice of Start of Issue, Event, Condition, Circumstance, or Cause of Perceived Delay, Disruption, Interference, Hindrance, Acceleration. (Article 12.2.1 of the General Conditions).
 - 24. Final Notice of End of Issue, Event, Condition, Circumstance, or Cause of Perceived Delay, Disruption, Interference, Hindrance, Acceleration (Article 12.2.2 of the General Conditions).
 - 25. Storm Water Pollution Prevention.
 - 26. CEQA Compliance.
- E. No later than three (3) calendar days after each progress meeting, OAR will prepare and distribute minutes of the meeting to each present and absent party. Include a brief summary, in narrative form, of progress, decisions, directives, actions taken, and all other issues since the previous meeting and report.
- 1. Schedule Updating: CONTRACTOR shall revise the Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized, and issue the revised schedule at the next scheduled progress meeting.

3.04 ADDITIONAL MEETINGS

- A. OAR, upon giving notice to the intended parties and without further obligation, may require additional meetings to discuss Work and/or Project related activities.

3.05 OWNER'S RIGHT TO RECORD

- A. CONTRACTOR agrees on behalf of itself and all its subcontractors that the OWNER may audiotape or videotape any meetings, training and any work at any time during the Project

END OF SECTION

SECTION 01 2613
REQUEST FOR CLARIFICATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Procedure for requesting clarification of the intent of the Contract Documents.

1.02 RELATED REQUIREMENTS

- A. Section 01 1100: Summary of Work.
- B. Section 01 3113: Project Coordination.
- C. Section 01 3213: Construction Schedule.
- D. Section 01 7700: Contract Closeout.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 PROCEDURE

- A. CONTRACTOR shall prepare a Request for Clarification and transmit the Request for Clarification to ARCHITECT with a concurrent copy to the OAR.
- B. ARCHITECT response is a clarification of the intent of the Contract Documents and does not authorize changes in the Contract Amount, Milestones and/or Contract Time.
- C. A Request for Clarification may be returned with a stamp or notation "Not Reviewed," if:
 - 1. The requested clarification is ambiguous or unclear.
 - 2. The requested clarification is equally available to the requesting party by researching and/or examining the Contract Documents.
 - 3. CONTRACTOR has not reviewed the Request for Clarification prior to submittal.
- D. Allow a minimum of nine days for review and response time, after receipt by ARCHITECT and OAR. CONTRACTOR shall verify and is responsible in verifying ARCHITECT and OAR receipt of a Request for Clarification.
- E. Changes or alterations to the approved drawings or specifications shall be made by means of addenda or change orders as per section 4-338 of the California Building Standards Commission's, California Administrative Code.

END OF SECTION

SECTION 01 2973
SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Procedure for submission of a certified Schedule of Values for review and approval by the OAR.

1.02 RELATED REQUIREMENTS

- A. Section 01 2976: Progress Payment Procedures.
- B. Section 01 3113: Project Coordination.
- C. Section 01 3300: Submittal Procedures.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 PREPARATION

- A. Upon receipt of the Notice of Intent to Award, CONTRACTOR shall commence preparation of a Schedule of Values.
- B. CONTRACTOR shall coordinate the preparation of a Schedule of Values with preparation of the Construction Schedule as set forth in Section 01 3213. The corresponding values from the specification division totals on cost loaded schedule shall match with the approved Schedule of Values.
- C. Include the following Project identification on a certified Schedule of Values:
 - 1. Project name and location.
 - 2. Project Number.
 - 3. Contract #.
 - 4. CONTRACTOR name.
 - 5. Date of Submittal.

- D. The Schedule of Values shall be in tabular form with separate columns and shall include the following items:
1. Related Specification Section and Division.
 2. Description of Work.
 3. Name of Subcontractor, manufacturer or supplier.
 4. Dollar value, quantity and unit of measure of each line item.
 5. Percentage of Contract amount to nearest one-hundredth percent, adjusted to total 100 percent.
- E. Round amounts to the nearest whole dollar; the total shall equal the Contract Amount.
- F. Provide a breakdown of the Contract Amount in enough detail acceptable to OAR to facilitate continued evaluation of Application for Payment and progress reports. Provide line items for subcontract amounts, where appropriate.
- G. Provide separate line items for items in the Schedule of Values for total installed value of that part of the Work.
- H. Provide separate line item for labor and material when required by the OAR.
- I. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item except the amounts shown as separate line items.
- J. Temporary facilities and other cost items that are not direct cost of actual work-in- place shall be shown as separate line items.
- K. An approved certified Schedule of Values shall serve as the basis for the monthly certified Application for Payment.
- L. If at any time, OWNER determines, in its reasonable discretion, that the schedule of Values does not approximate the actual cost being incurred by CONTRACTOR to perform the Work, CONTRACTOR shall prepare, for OAR approval, a revised Schedule of Values, which then shall be used as the basis for future progress payments. Without changing the Contract Amount, OWNER reserves the right to require CONTRACTOR:
1. To increase or decrease amounts within the line items in the Schedule of Values; and,
 2. To conform the price breakdown to OWNER accounting practice.

3.02 SUBMITTAL

- A. CONTRACTOR shall submit five certified copies of a Schedule of Values for review and approval by the OAR at least 14 days before the first Application for Payment.
- B. OAR will review and if necessary, return the submitted Schedule of Values with summary comments noting items not in compliance with the requirements of the Contract Documents. CONTRACTOR shall revise the submitted Schedule of Values and return five copies within three days of receipt of summary comments.
- C. Signature by OAR shall constitute acceptance of the submitted Schedule of Values.
- D. An approved copy of the Schedule of Values by OAR will be transmitted to CONTRACTOR, and Inspector.

END OF SECTION

SECTION 01 4525

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 – GENERAL

1.01 SUMMARY

A. SECTION INCLUDES

1. This Section specifies the requirements for test and balance of HVAC and related systems.

B. RELATED REQUIREMENTS

1. Section 01 1100: Summary of Work.
2. Section 01 3113: Project Coordination.
3. Section 01 3213: Construction Schedule.
4. Section 01 3300: Submittal Procedures.
5. Section 01 7700: Contract Closeout.
6. Section 23 0500: Common Work Results for HVAC.
7. Section 23 0513: Basic HVAC Materials and Methods.
8. Section 23 0548: HVAC Sound, Vibration and Seismic Control.
9. Section 23 0900: HVAC Instrumentation and Controls.
10. Section 23 0923: Environmental Control and Energy Management Systems (Only include when DDC Energy Management and Control Systems are provided).
11. Section 23 2013: HVAC Piping.
12. Section 23 3000: Air Distribution.
13. Section 23 3813: Kitchen Ventilation System.
14. Section 23 5000: Central Heating Equipment
15. Section 23 6416: Oil Lubricated Centrifugal Water Chillers.

16. Section 23 6418: Oil Free Centrifugal Water Chillers.
17. Section 23 6423: Scroll Water Chillers.
18. Section 23 6426: Rotary-Screw Water Chillers.
19. Section 23 6428: Air-Cooled Rotary Screw Chillers.
20. Section 23 6500: Cooling Towers.
21. Section 23 8000: Heating, Ventilating and Air Conditioning Equipment.
22. Section 28 3149: Carbon Monoxide Detection and Alarm Systems.

PART 2 – PRODUCTS (Not used)

PART 3 – EXECUTION

3.01 DEFINITIONS AND APPLICABLE PUBLICATIONS

- A. For the purposes of this Section definitions are as indicated in applicable publications of AABC, NEBB, TABB, ASHRAE, ANSI and SMACNA.
 1. TAB: Testing, Adjusting and Balancing.
 2. TABB: Testing, Adjusting and Balancing Bureau.
 3. AABC: Associated Air Balance Council.
 4. NEBB: National Environmental Balancing Bureau.
 5. ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers.
 6. ANSI: American National Standards Institute.
 7. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.
 8. OAR: OWNER'S Authorized Representative

3.02 QUALITY ASSURANCE

- A. The General Contractor shall contract directly with the test and balance agency. Tests performed by testing agencies contracted with the system's subcontractor will not be accepted. The qualifications of the agency shall comply with Article 3.02, Quality Assurance. The agency shall be responsible for furnishing labor, instruments, and tools required to test, adjust, and balance the heating, ventilating, and air conditioning

(HVAC) systems and related plumbing systems, as described and/or as indicated in the Contract Documents.

- B. CONTRACTOR shall obtain services of an independent, qualified testing agency acceptable to Architect to perform testing and balancing Work as specified and as follows:
1. Agency shall be currently certified by either the Associated Air Balance Council (AABC), the National Environmental Balancing Bureau (NEBB), or the Testing, Adjusting and Balancing Bureau (TABB). NEBB or TABB certification shall be for Air and Hydronic Testing, Adjusting and Balancing and Sound and Vibration Measurement.
 2. Work shall be in accordance with the latest edition of the AABC, NEBB, or TABB National Standards. Where the requirements of the two standards are different, the more stringent requirements shall prevail. Also, if the Contract Documents impose a more stringent standard, then the Contract Documents shall prevail.
- C. Performance Criteria: Work of this Section shall be performed in accordance with approved Testing, Adjusting, and Balancing agenda.
- D. Test Equipment Criteria: Basic instrumentation requirements and accuracy/calibration required by Section Two of the AABC, Section II of the NEBB, or TABB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems.
- E. Verification: The Test and Balance Agency shall recheck 10 percent (minimum 10) of the measurements listed in the report. The locations shall be selected by PROJECT INSPECTOR or OAR. The recheck will be witnessed by PROJECT INSPECTOR or OAR. If 20 percent of the measurements that are retested differ from the report and are also out of the specified range, an additional 10 percent will be tested. If 20 percent fall outside the specified range, the report will be considered invalid and all test and balance work shall be repeated.
- F. Due to more stringent acoustical requirements in the educational environment, the Test and Balance Agency shall recheck the air systems where the sound level is higher than the specified requirements and demonstrate compliance with the methodology specified in this document with emphasis on fan speed adjustment and balancing for optimum acoustical performance. The recheck will be witnessed by PROJECT INSPECTOR or OAR. When there are multiple air systems, a system selected by PROJECT INSPECTOR or OAR shall be rechecked. If this system is found to be not in compliance, a second system shall be checked. If the second system is also found to be not in compliance, the report will be considered invalid, and all test and balance work shall be repeated.

3.03 SUBMITTALS

- A. Submit name of agency to perform the Work. Include in the submittal the certified qualifications of all persons responsible for supervising and performing actual Work of this Section. Agency shall submit a minimum of five commercial or industrial HVAC system TAB projects of similar type, size, and degree of difficulty completed within the last two years. Agency shall provide name and telephone number of contact person for each listed project.
- B. Submit, for approval, 6 copies of the Agenda as indicated in Article 3.06 to test and balance all mechanical and relevant plumbing systems.
- C. Preliminary Report: Review the Contract Documents, examine Work installations and submit a written report to ARCHITECT, PROJECT INSPECTOR and OAR indicating deficiencies in Work precluding proper testing and balancing of the Work.
- D. Final TAB Report: Submit the final TAB report for review by ARCHITECT, PROJECT INSPECTOR, and OAR outlining the conditions and Work completed on each HVAC system. All outlets, devices, HVAC equipment, etc. shall be identified, along with a numbering system corresponding to report unit identification.
- E. Submit an AABC “National Project Performance Guaranty” or “NEBB Quality Assurance Certification”, assuring the Project systems were tested, adjusted, and balanced in accordance with the Specifications and AABC, NEBB, or TABB National Standards.
- F. CAD drawings: Submit single line, multi-color CAD drawings indicating outside return and supply air, volume control boxes, each outlet and inlet, room numbers, duct sizes at traverse locations, temperatures and pressures, systems balanced, components changed, and CONTRACTOR installed access points. In addition, drawings shall identify controls, equipment settings, including manual damper quadrant positions, manual valve indicators, fan speed control levers, and similar controls, and devices shall be marked on the drawings to show final settings. CAD files shall be submitted on CD-ROM upon final submittal of TAB report. Reports shall identify discrepancies between completed Work and the Contract Documents affecting the performance and longevity of the system.

3.04 GENERAL SCOPE OF WORK

- A. The general scope of Work shall include but not be limited to the following:
 - 1. Measure airflow rates of HVAC systems and make adjustments to achieve design airflow rates, tabulate results, and submit reports.
 - 2. Measure water-flow rates of HVAC systems and make adjustments to achieve design water flow rates, tabulate results, and submit reports.
 - 3. Measure flow velocities, temperatures, static pressures or head, rotational speed, and electrical power demand of fans, pumps, and other related HVAC system components, tabulate results, and submit reports.

4. Measure sound levels in each conditioned space, tabulate results, and submit reports.
5. Measure ambient sound levels of outdoor HVAC units and system components such as chillers and cooling towers, tabulate results, and submit reports.
6. Reports shall contain sufficient data for the system designer to evaluate system performance and solve installation problems such as system pressure profiles and pressure drops across system components

3.05 SPECIFIC SCOPE OF WORK

- A. The specific scope of [□] Work shall include the following HVAC system components as indicated on the Drawings:
1. Air Handling Units.
 2. Air Conditioning Units.
 3. Heating and Ventilating Units.
 4. Heating and Cooling Coils.
 5. Supply, Return, Relief and Exhaust Fans.
 6. Outside Air and Return Air Plenums.
 7. Outside Air Intakes.
 8. All Supply and Return Ductwork.
 9. All associated Air Terminal Devices, i.e. Supply Diffusers, Return Registers, etc.
 10. Mixing Boxes and Variable Air Volume (VAV) boxes.
 11. Reheat Coils (Electric or Hot Water).
 12. Exhaust Duct Systems.
 13. Fire and Fire/Smoke Dampers.
 14. Kitchen Hoods.
 15. Laboratory Hoods.
 16. Heat Exchangers.
 17. Chillers.

18. Cooling Towers.
19. Boilers.
20. Chilled water, heating hot water and cooling tower water pumps.

3.06 TESTING, ADJUSTING, AND BALANCING AGENDA

- A. Provide proposed materials, methods, procedures, forms, diagrams, and reports for test and balance Work.
- B. Agenda to be completed by the test and balance agency and submitted to ARCHITECT, PROJECT INSPECTOR, and OAR for review and approval.
- C. Agenda shall include one complete set of AABC, NEBB, or TABB publications listed in Sub-paragraph 3.02.B.2, applicable publications, or, in case of other test and balance agencies and or organizations, comparable publications to establish an approved, systematic, and uniform set of procedures.
- D. Agenda shall also include the following detailed narrative procedures, system diagrams, and forms for test results:
 1. Specific standard procedures required and proposed for each system of the Work.
 2. Specified test forms for recording each procedure and for recording sound and vibration measurements.
 3. Systems diagrams for each air, water, and steam system. Diagrams may be single line.
- E. In addition to information recorded for standard AABC, NEBB, or TABB procedures, the following information is required:
 1. Fan data.
 2. System number, location, manufacturer, model, and serial number.
 3. Fan wheel type and size.
 4. Motor horse power, type, and rpm.
 5. Sheave size, type, number of grooves, and open turns on Variable Pitch Sheave.
 6. Number and size of belts, motor and fan shaft sizes, center-to-center of shafts in inches, and adjustment available motor data, including nameplate data, actual amps, rated, and actual motor rpm, volts, phase, hp, kW, starter heater size, and capacity.

7. Fan design airflow and service (supply, return, outdoor air or exhaust).
 8. Fan static pressure, suction/discharge, static profile, and static control point.
- F. The following traverse data is required:
1. Traverse location, size of duct (inside dimensions), and area of duct in square feet.
 2. Column for each hole traversed/lines for each reading.
 3. Barometric pressure.
 4. Temperature/Static pressure in the duct.
 5. Actual CFM corrected to SCFM.
 6. Notes.
- G. The following air distribution data is required:
1. Room identification.
 2. Outlet or intake balance sequence number.
 3. Size of outlet or inlet.
 4. AK Factor.
 5. Design and Actual FPM and CFM.
 6. Notes.
- H. The following hydronic coil data is required:
1. Air flow through the coil in CFM.
 2. Dry bulb and wet bulb temperatures entering/leaving coil.
 3. Enthalpy or total heat differences in BTU/pound.
 4. Capacity in BTU/hour at time of test.
 5. Water temperature and pressure entering/leaving coil.
 6. Flow (in GPM) through coil.
 7. Air pressure drop across coil.
 8. Water head drop across coil.

9. Notes.
- I. The following DX coil data is required:
 1. Air flow through the coil in CFM.
 2. Dry and wet bulb temperatures entering/leaving coil.
 3. Enthalpy or total heat difference across coil in BTU/ pound.
 4. Capacity in BTU/hour at time of test.
 5. Air pressure drop across coil.
 6. Notes.
 - J. The following data is required for steam to water heat exchangers for heat and/or domestic generation:
 1. Exchanger identification number.
 2. Nameplate data; manufacturer, model, and serial number.
 3. Temperature entering/leaving unit.
 4. Flow through unit in GPM.
 5. Pressure drop through unit.
 6. Entering steam pressure.
 7. Notes.
 - K. The following electric heating coil data is required:
 1. Heating coil identification number.
 2. Nameplate data; manufacturer, model and serial number.
 3. Amperage/Voltage on each phase.
 4. Phase, kW, and Stages.
 5. Safety device installed.
 6. Air pressure drop across coil.
 7. Notes.
 - L. The following water-cooled chiller data is required:

1. Identification number.
2. Nameplate data; manufacturer, model and serial number.
3. Chilled water flow through evaporator in GPM.
4. Water temperature entering/leaving evaporator.
5. Pressure drop through evaporator.
6. Condenser water flow through.
7. Pressure drop through condenser.
8. Water temperature entering/leaving condenser.
9. Motor data, amps, volts, rpm, starter type, overload protection type, phase, hertz, nameplate, and actual measured kW input.
10. Type of refrigerant.
11. Notes.

M. The following cooling tower data is required:

1. Identification number.
2. Nameplate data; manufacturer, model and serial number.
3. Performance test results for rated capacity.
4. Water flow through the tower in GPM.
5. Water temperature entering/leaving tower.
6. Outside Air dry and wet bulb temperatures.
7. Motor data, amps, volts, phase, hertz, and kW input.
8. Starter size and type and heater size and capacity.
9. Water droplets leaving tower - yes/no.
10. Water balanced across tower pans and basins.
11. Airflow across the tower within design rating according to fan curves.
12. Notes.

N. The following boiler and domestic water heater data is required:

1. Performance test results for rated capacity.
 2. Boiler identification number.
 3. Nameplate data; manufacturer, model, and serial number.
 4. Water temperature entering/leaving the boiler.
 5. Outside conditions: temperature, humidity, general cloud cover.
 6. Barometric pressure.
- O. The following air-cooled split system condensing unit data is required:
1. Performance test results for rated capacity.
 2. Unit identification number.
 3. Nameplate data, manufacturer, model, and serial number.
 4. Compressor nameplate and actual amps, volts, phase, and hertz.
 5. RPM of motors, where applicable.
 6. Refrigerant type.
 7. Suction/Discharge pressure when gage installed.
 8. Number of stages.
 9. Low-pressure/High-pressure control setting.
 10. Condenser fan sequence stages.
 11. Crankcase heater watts (nameplate).
 12. Hot gas bypass installed - yes/no.
 13. SCFM Air Flow Measurement vs. Design CFM.
- P. The following air-cooled split system heat pump data is required:
1. Performance test results for rated heating and cooling capacities.
 2. Unit identification number.
 3. Nameplate data, manufacturer, model, and serial number.
 4. Compressor nameplate and actual amps, volts, phase, and hertz.

5. RPM of motors, where applicable.
 6. Refrigerant type.
 7. Suction/Discharge pressure for both heating and cooling modes when gage installed.
 8. Number of stages.
 9. Low-pressure/High-pressure control setting.
 10. Condenser fan sequence stages.
 11. Crankcase heater watts (nameplate).
 12. Hot gas bypass installed - yes/no.
 13. SCFM Air Flow Measurement vs. Design CFM.
- Q. The following sound test data is required:
1. Area or location.
 2. Sound level in dB(A) as specified in Article 3.19.
 3. Sound level at the center band frequencies of eight non-weighted octaves with equipment on and off for 5 rooms selected by the OAR/PROJECT INSPECTOR.
 4. Plot of corrected sound-level reading on Noise Criteria (NC) curve for the measurements in Q 3 above.
- R. The following vibration test data is required:
1. Equipment identification number.
 2. Vibration levels at all accessible bearings, motors, fans, pumps, casings, and isolators.
 3. Measurements in mils deflection and velocity in inches per second.
 4. Each measurement taken in horizontal, vertical, and axial planes as accessible.
- S. The following mixing damper leakage test data is required:
1. Equipment identification number (unit, box, zone, etc.).
 2. Dry bulb temperature in the cold/hot (or bypass) deck.
 3. Dry bulb temperature in the mixed air stream.

4. Calculated percent leakage.
 5. Data above taken in the full cool and full heat (or bypass) mode.
 6. Notes.
- T. The following airflow station data is required:
1. Station identification number.
 2. Nameplate data including effective area.
 3. Differential test pressure or velocity.
 4. Calculated CFM.
 5. Actual CFM (from Pitot-tube traverse form).
 6. Read out CFM.
 7. Notes
- U. The following unit heater data is required:
1. Equipment identification number.
 2. Nameplate data; manufacturer, model, and serial number.
 3. Test CFM (use manufacturer rated CFM if not ducted).
 4. Heat test data per applicable procedure (hot water, electric, etc.).
 5. Notes.
- V. The following fan coil and unit ventilator data is required:
1. Equipment identification number.
 2. Nameplate data; manufacturer, model, and serial number.
 3. Tested supply CFM or manufacturer rated CFM if not ducted.
 4. Tested outside air in CFM.
 5. Motor data and actual amps and volts.
 6. Cooling/Heating test data.
 7. Static pressure.

8. Notes.

W. The following kitchen hood data is required:

1. Hood identification number.
2. Nameplate data; manufacturer, model, and serial number.
3. Pitot-tube traverse total air flow.
4. Exhaust and supply (when part of hood) CFM.
5. Exhaust and supply (when part of hood) test velocities shown on hood face diagram.
6. Face velocities.
7. Hood opening dimensions.
8. Notes (turbulence and flow patterns at the face and inside the hood).

X. The following laboratory hood data is required:

1. Hood identification number.
2. Nameplate data; manufacturer, model, and serial number.
3. Pitot-tube traverse total air flow.
4. Exhaust and supply (when part of hood) CFM.
5. Exhaust and supply (when part of hood) test velocities shown on hood face diagram.
6. Face velocities.
7. Hood opening dimensions.
8. Notes (turbulence and flow patterns at the face and inside the hood).

Y. The following data for water-to-water heat exchangers for domestic and/or heating is required:

1. Exchanger identification number.
2. Nameplate data; manufacturer, model, and serial number.
3. GPM and Pressure drop through each side.
4. Capacity of each side.

5. Notes.
- Z. The following pump data, including but not limited to, chilled water, heating hot water, cooling tower water, boiler feed, domestic hot water booster, domestic hot water circulation, sewage ejectors, sump pumps and domestic hot water booster is required:
1. Pump number.
 2. Nameplate data; manufacturer, model, and serial number.
 3. Motor data including nameplate data, actual amps, volts, RPM, horsepower, starter heater size, and capacity.
 4. Pump discharge and suction pressure along with total dynamic head in the following modes.
 5. Shut-off head FT, Wide open Head FT, and Final operating Head FT.
 6. Final GPM Test plotted on a pump curve.
 7. Notes.
- AA. The following water flow station data is required:
1. Station identification number.
 2. Nameplate data; manufacturer, model, and serial number.
 3. Design and actual GPM.
 4. Differential test pressure.
 5. Setting (open turns, degree, etc.) if required GPM.
 6. Notes.
- BB. The following terminal box data is required:
1. Box identification number.
 2. Node, address, or designation on system.
 3. Box size.
 4. Cooling CFM.
 5. Minimum CFM (if applicable).
 6. Heating CFM (if applicable).

7. Box fan amps and volts (if applicable).
8. For DDC controlled boxes, record computer readout maximum, minimum, and heat, along with box correction factor for calibrating to true CFM.
9. Notes.

3.07 PROCEDURES

- A. Schedule the Work of this Section in order for test and balance activities to be completed prior to the date of Substantial Completion. CONTRACTOR shall place all heating, ventilating, and air conditioning equipment into operation during each day and until all HVAC adjusting, balancing, testing, demonstrations, and instructions on systems are completed. Agency shall prepare and submit reports within ten (10) days from completion of the Work of this Section to allow sufficient time for corrective measures to be completed before Substantial Completion of the Work. When an individual building or portion thereof is ready for occupancy, all equipment relative to such portion of Work shall be put into service, tested, and balanced.
- B. Prior to the date of Substantial Completion, and upon completion of test and balance Work, place all exhaust fans in operation, force all air handling units, and air conditioning units into a 100 percent outdoor air economizer mode with heating and cooling locked out and flush the building continuously for a period of fourteen (14) days.
- C. Coordinate test and balance procedures with any phased Project requirements so test and balance procedures on each phased portion of the Work will be completed prior to completion of said designated phase.

3.08 FIELD EXAMINATION

- A. Before the commencement of test and balance Work, CONTRACTOR shall ascertain that following conditions are fulfilled:
 1. Ensure that all water heating and water cooling systems have been flushed, cleaned, and filled and high points vented.
 2. Boilers (steam and hot water) are filled.
 3. Refrigerant systems are fully charged with specified refrigerant.
 4. Over-voltage and current protection have been provided for motors.
 5. Equipment has been labeled as required.
 6. Curves and descriptive data on each piece of equipment to be tested and adjusted are available as required.
 7. Operations and maintenance manuals have been supplied.

8. Controls manufacturer and boiler-burner representatives shall be available for consultation and supervision of adjustments during tests.
 9. Verify that heating and cooling coil fins are cleaned, combed and air filters clean, and installed.
 10. Verify that duct systems are clean of debris and leakage is minimized, access doors are closed and duct end caps are in place, and fire and volume dampers are in place and open.
 11. Automatic control systems are completed and operating.
 12. Start up and initial commissioning of all HVAC equipment except fans shall be by the manufacturer.
- B. In addition to the above, CONTRACTOR shall establish a specific, coordinated plan which details how each area of existing building will be balanced during the various phases of the Work. The evaluation shall address, at a minimum, the following concerns:
1. OWNER operations.
 2. Building safety and security policies. Prior to any fire safety or security systems shutdown at any time during the Work, CONTRACTOR shall first advise and coordinate with OWNER to ensure all concerned parties are notified.
 3. Protecting furniture, computers, photocopiers, and other office equipment.
 4. Protecting classroom fixtures and equipment.
 5. Concerns specific and unique to building related issues.
 6. Downtime required for each Air Handling Unit including projected time to return each portion of the building back to its normal occupancy temperature and humidity.
 7. Shutdown and reactivation of the fire alarm system to avoid accidental alarms during test and balance and related Work.

3.09 TEST AND BALANCE

- A. For each heating, ventilating, or air conditioning system the following shall be performed, recorded, and submitted in an approved format for review. Make, type, and model of unit, and location of each piece of equipment shall be included in the report. Readings shall include but not be limited to following:
1. Air Systems:

- a. General
 - 1) Verify all ductwork, dampers, grilles, registers, and diffusers have been installed per design and set in the full open position. Agency shall perform the following TAB procedures in accordance with AABC or NEBB National Standards. Where the requirements of the two standards are different, the more stringent requirements shall prevail. Also, if the Contract Documents impose a more stringent standard then the Contract Documents shall prevail.
- b. Zone, Branch, and Main Ducts:
 - 1) Adjust ducts to within design CFM requirements by means of Pitot-tube duct traverse.
- c. Supply Fans:
 - 1) Fan Speeds: Test and adjust fan RPM to achieve maximum or design CFM. CONTRACTOR shall provide new belt pulleys when required.
 - 2) Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits. Ensure fan motor is not in or above the service factor as published by the motor manufacturer.
 - 3) Pitot-Tube Traverse: Perform a Pitot-tube traverse of main supply and return ducts, record total CFM.
 - 4) Outside Air: Test and adjust the outside air using Pitot-tube traverse.
 - 5) Static Pressure: Test and record system static profile of each supply fan.
 - 6) Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits. Ensure fan motor is not in or above the service factor as published by the motor manufacturer.
- d. Return, Relief, and Exhaust Fans:
 - 1) Fan Speeds: Test and adjust fan RPM to achieve maximum or design CFM. CONTRACTOR shall provide new belt pulleys where required.

- 2) Pitot-Tube Traverse: Perform a Pitot-tube traverse of the main return ducts to obtain total CFM.
 3. Static Pressure: Test and record system static profile of each fan.
- e. VAV Systems:
- 1) Set volume regulators on all terminal boxes to meet design maximum and minimum CFM requirements.
 - 2) Identification: Identify the type, location, and size of each terminal box. This information shall be recorded on terminal box data sheets.
- f. Diffusers, Registers and Grilles:
- 1) Tolerances: Test and balance each diffuser, grille, and register to within 5 percent of design requirements.
 - 2) Identification: Identify the type, location, and size of each grille, diffuser, and register. This information shall be recorded on air outlet data sheets.
- g. Coils: Air Temperature: Once airflow is set to acceptable limits, agency shall take wet bulb and dry bulb air temperatures on the entering and leaving side of each cooling coil. Dry-bulb temperature shall be taken on the entering and leaving side of each heating coil.
- h. Duct Leakage Testing:
- 1) On existing ductwork, agency shall calculate duct leakage by traversing the unit and reading associated diffusers.
 - 2) On new installations each and every section of the entire air distribution system (all supply, return, exhaust, and relief ductwork) shall be tested at 1.5 times design static pressure. All ducts shall demonstrate 5 percent leakage maximum (per CBC).
- i. Air Handling Units:
- 1) Prepare pressure profile and show design and actual CFM (outside air, return air, and supply air).
 - 2) Measure and record each mode (minimum OA and 100 percent OA) where economizer cycle is specified.

- 3) Record pressure drops of all components (coils, filters, sound attenuators, louvers, dampers, and fans) and compare with design values.
 - 4) Pressure profile and component pressure drops are performance indicators and are not to be used for flow measurements.
- j. System Pressure Profiles:
- 1) Prepare pressure profiles from fan (supply, return, and exhaust) or air handling unit to extremities of system.
 - 2) As a minimum, show pressure at each floor, main branch, and airflow measuring device.
 - 3) Make pitot-tube traverses of all trunk lines and major branch lines where required for analysis of distribution system. Airflow measuring devices installed in ductwork, if available, may be utilized.
 - 4) Record residual pressures at inlets of volume controlled terminals at ends of system.
 - 5) Show actual pressures at all static pressure control points utilized for constant or variable flow systems.
- k. Fan speed adjustments and balancing for optimum acoustical performance:
- 1) As the very first step, the speed of all fans (supply, return, and exhaust inside packaged equipment or air handling units) shall be adjusted to deliver the required fan total air quantity with all volume dampers and other flow rate control devices fully open. Adjustments shall be made with the outdoor air intake dampers, return air dampers, and relief air dampers in the minimum outdoor air position. The adjustments shall be made again in the 100 percent outdoor air position in systems with 100 percent outdoor air economizers.
 - 2) The above adjustment shall be done with wet cooling coils, where cooling coils are provided.
 - 3) The airflow rates at each branch duct shall be adjusted as the second step with air with all volume dampers and other flow rate control devices fully open.
 - 4) The airflow rates at each air inlet and outlet shall be adjusted as the final step. The volume damper in the branch duct shall be

used for balancing. Opposed blade dampers at air inlets and outlets where provided shall only be used for fine adjustments and shall not be closed beyond 60 percent open or when the dampers start to generate audible noise.

5) CONTRACTOR shall provide the labor and materials for all dampers, pulleys, and belt changes required for balancing. The design documents indicate the worst-case scenario with safety factors in fan static pressures for contingency. Properly coordinated and installed air systems may require a lower static pressure and a reduction in fan speed.

2. Water Systems: CONTRACTOR shall confirm all equipment, piping, and coils have been filled and purged, strainers are clean, and all balancing valves (except bypass valves) are set full open. Agency shall perform the following TAB procedures in accordance with the AABC, TABB, or NEBB National Standards:

B. Pumps:

1. Test and adjust chilled water, hot water, and condenser water pumps to achieve maximum or design GPM.
2. Measure and record suction and discharge pressures.
3. Check pumps for proper operation. Pumps shall be free of vibration and cavitation.
4. Current and Voltage: Agency shall test and record motor voltage and amperage and compare data with the nameplate limits. Ensure pump motor is not in or above the service factor as published by the motor manufacturer.
5. Adjust pump flow by adjusting and setting balancing valves to obtain amperage reading on a clamp-on ammeter that corresponds to amperage indicated on pump's curves for required flow.
6. Verify that the motor is not drawing more current than indicated on motor plate rating. When actual flows of primary pumps are found by test to vary more than 5 percent from specified amount, system shall be re-balanced to regulate flow within this tolerance. When a flow indicating device(s) is in circuit, it shall be used to verify pump flows.
7. When testing is completed, a pump capacity chart with pump number and location indicated shall be marked indicating operating point of pump on the curve. Chart shall then be included in the report.

C. Cooling Towers:

1. Test and balance water flows, balance tower cells, and flows between towers.
 2. Test and record temperature profiles for water and airside operation.
 3. Outside Climatic Conditions: Outside air dry bulb (DB) temperature, wet bulb (WB) temperature, and atmospheric conditions, during temperature profile runs.
- D. Chillers: (Start-up and initial commissioning by manufacturer only.)
1. Test and balance chiller water flows to achieve maximum or design GPM.
 2. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits. Ensure compressor motor is not in or above the service factor as published by the motor manufacturer.
 3. Test and record temperature and pressure profiles of chillers.
 - a. Inlet and outlet water temperature.
 - b. Inlet and outlet water pressure.
 - c. Evaporator temperature.
 - d. Condensing temperature pressure.
 - e. Purge pressure.
 - f. Oil temperature and pressure.
 4. Outside Climatic Conditions: Outside air DB temperature, WB temperature, and atmospheric conditions, during temperature profile runs.
- E. Boilers: (Start-up and initial commissioning by manufacturer only.) Test and balance boilers only after test and balance of pumps have been completed. Boilers shall not be initially operated or tests performed with students or faculty on the Project site. Boilers shall be tested for the following:
1. Heating Hot Water Boilers and Domestic Hot Water Boilers:
 - a. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits. Ensure motor is not in or above the service factor.
 - b. Test and balance water flow through water boilers.
 - c. Test and record temperature and pressure profiles of water and/or steam boilers.

- d. Upon completion of tests, controls and devices shall be returned to their normal operating condition and boiler shall remain in service.
2. Steam Boilers: Start-up and initial commissioning by manufacturer only.
- F. Heat Exchangers:
 1. Steam to Hot Water Heat Exchanger: Steam pressure, entering and leaving hot water temperatures, gpm flow, pressure drop, and control set point.
 2. Water to Water Heat Exchanger:
 - a. Primary Heating Water: Entering and leaving hot water temperatures, gpm flow, and pressure drop.
 - b. Secondary Heated Water: Entering and leaving hot water temperatures, gpm flow, pressure drop, and control set point.
- G. Coils:
 1. Tolerances: Test and balance all chilled-water and hot-water coils within 5 percent of design requirements.
 2. Verify the type, location, final pressure drop, and GPM of each coil.
- H. System Mains and Branches including chilled water, heating hot water, cooling tower water, domestic hot water and domestic cold water:
 1. Balance water flow in pipes to achieve maximum or design GPM.
- I. Steam Heating Systems:
 1. Heating Coils: Steam pressure at coils, cfm, coil pressure drop, entering and leaving air dry bulb temperatures.
 2. Boilers:
 - a. Steam pressure, temperature, and quantity of feed-water (see Testing and Adjusting procedures).
 - b. Make, type, serial number, and rated capacity.
 - c. Flue gas temperature at boiler outlet ahead of back-draft diverter.
 - d. Percent carbon dioxide in flue gas.
 - e. Condensate quantities and temperatures.

3. Air Conditioning Units: (Start-up and initial commissioning by manufacturer only.)
 - a. Suction pressure and temperature.
 - b. Discharge pressure and temperature.
 - c. Amps and volts.
 - d. Make, type, and model of unit, capacity rating.
 - e. Ambient temperature: WB, DB.
 - f. Supply, return, relief, and exhaust fans shall be balanced as indicated in Section 3.09, A, 1, Air Systems.
 - g. Proper operation of controls: Temperature controllers and safety devices shall be tested during operating tests, with all other controls and devices, except one under test, being by-passed.
 - h. Upon completion of tests, controls and devices shall be returned to their normal operating condition and boiler shall remain in service.
4. Condensing and Refrigerating Units: (Start-up and initial commissioning by manufacturer only.)
 - a. Suction pressure and temperature.
 - b. Discharge pressure and temperature.
 - c. Amps and volts.
 - d. Make, type, and model of unit, capacity rating.
 - e. Ambient temperature: WB, DB.
 - f. Proper operation of controls: Temperature controllers and safety devices shall be tested during operating tests, with all other controls and devices, except one under test, being by-passed.
 - g. Upon completion of tests, controls and devices shall be returned to their normal operating condition and boiler shall remain in service.
5. Split System Heat Pump Units: (Start-up and initial commissioning by manufacturer only.)
 - a. Suction pressure and temperature.
 - b. Discharge pressure and temperature.

- c. Amps and volts.
- d. Make, type, and model of unit, capacity rating.
- e. Ambient temperature: WB, DB.
- f. Supply, return, relief and exhaust fans shall be balanced as indicated in Sub-paragraph 3.09.A.1, Air Systems.
- g. Proper operation of controls: Temperature controllers and safety devices shall be tested during operating tests, with all other controls and devices, (except one under test) being by-passed.
- h. Upon completion of tests, controls and devices shall be returned to their normal operating condition and boiler shall remain in service.

6. MISCELLANEOUS:

- a. Electric Heaters:
 - 1. Amperage.
 - 2. Voltage.
 - 3. Make, type, model, and name plate capacity rating.

3.10 VERIFICATION OF HVAC CONTROLS

- A. Agency shall verify in conjunction with CONTRACTOR all control components are installed in accordance with the intent of the Contract Documents and are functioning according to the design intent, including all electrical interlocks, damper sequences, air and water resets, fire stats, and other safety devices.
- B. CONTRACTOR shall verify all control components are calibrated and set for design operating conditions and intent.

3.11 TEMPERATURE TESTING

- A. To verify system control and operation, agency shall perform a series of three temperature tests taken at approximately two hour intervals in each separately controlled zone. The resulting temperatures shall not vary more than two degrees Fahrenheit from the thermostat or control set point during the tests. Outside temperature and humidity shall also be recorded during the testing periods.

3.12 KITCHEN HOOD TESTING

- A. Agency shall test and adjust hood total airflow by duct Pitot-tube traverse. If a Pitot-tube traverse is not practical, an explanation of why a traverse was not made must be made in writing to Architect and subsequently appear on the appropriate data sheet.

Face velocities shall be tested under design operating conditions using a maximum of a one square foot grid pattern across the entire open face. CONTRACTOR shall set sash height on hoods to obtain face velocities within 20 percent of 100 feet per minute unless specified otherwise. Agency shall test and adjust exhaust airflows and make-up air flows to maintain design hood pressures and face velocities and design room pressurization. Agency shall test for turbulence and proper air flow patterns at the face and inside the hoods using a hand-held smoke puffer or other approved smoke- emitting device.

3.13 FUME HOOD TESTING

- A. Agency shall test and adjust fume hood total airflow by duct Pitot-tube traverse. If a Pitot-tube traverse is not practical, an explanation of why a traverse was not made must be made in writing to Architect and subsequently appear on the appropriate data sheet. Face velocities shall be tested under design operating conditions using a maximum of a one square foot grid pattern across the entire open face. CONTRACTOR shall set sash height on hoods to obtain face velocities within 20 percent of 100 feet per minute unless specified otherwise. Agency shall test and adjust VAV controllers to obtain design exhaust airflows and make-up air flows to maintain design hood pressures and face velocities and design room pressurization. Agency shall test for turbulence and proper air flow patterns at the face and inside the hoods using a hand-held smoke puffer or other approved smoke-emitting device.

3.14 BUILDING/ZONE PRESSURIZATION

- A. Agency shall test and adjust building/zone pressurization by setting the design flows to meet the required flow direction and pressure differentials. Positive/Negative area(s) supply air shall be set to design flow and exhaust air rates adjusted to obtain the required pressure differential(s).

3.15 FIRE AND SMOKE DAMPER TESTING

- A. This work is to be performed by OWNER and State Fire Marshall. Do not include in agency scope of work.

3.16 LIFE SAFETY CONTROLS TESTING

- A. This work is to be performed by OWNER and State Fire Marshall. Do not include in agency scope of Work.

3.17 FINAL TABULATION

- A. After heating, ventilating, and air conditioning components are satisfactorily tested and balanced, entire system shall be put into operation and all pressures, temperatures, gpm, cfm, velocities, etc., shall be recorded and checked against design schedules. Design requirements shall be listed on reports and final tabulation shall be within a tolerance of plus or minus five percent of design requirements.

- B. Readings at various locations as described herein will be made every hour for four (4) hours, during normal working hours for three (3) days. Boilers, forced air furnaces, and chillers shall be started up far enough in advance to meet design conditions during period of testing.

3.18 VIBRATION TESTING

- A. Furnish instruments and perform vibration measurements if specified in Division 23. Provide measurements for all rotating HVAC equipment half horsepower and larger, including reciprocating/centrifugal/screw/scroll compressors, pumps, fans, and motors.
- B. Record initial and final measurements for each unit of equipment on test forms. Where vibration readings exceed allowable tolerance and efforts to make corrections have proved unsuccessful, forward a separate report to ARCHITECT.

3.19 SOUND TESTING

- A. Perform and record sound measurements as specified in this Section and in Section 23 0548: HVAC Sound, Vibration and Seismic Control. Take additional readings if required by ARCHITECT.
- B. Measuring equipment and methods shall comply with the current requirements of the AABC, NEBB, TABB and ANSI S12.60. Take measurements with a calibrated Type 1 sound level meter and octave band analyzer.
- C. Sound reference levels, formulae, and coefficients shall be according to ASHRAE Handbook: HVAC Applications, Chapter on Sound and Vibration Control.
- D. Where sound pressure levels are specified as noise criteria or room criteria in Section 23 0548: HVAC Sound, Vibration and Seismic Control determine compliance with the Contract Documents as follows:
 - 1. Reduce background noise as much as possible by shutting off unrelated audible equipment.
 - 2. Measure octave band sound pressure levels with specified equipment "off".
 - 3. Measure octave band sound pressure levels with specified equipment "on".
 - 4. Use difference in corresponding readings to determine sound pressure due to equipment. Sound pressure level, due to equipment equals sound pressure level with equipment "on" minus factor.

DIFF.:	0	1	2	3	4	5	9-10 or More
FACTOR:	10	7	4	3	2	1	0
 - 5. Plot octave bands of sound pressure level due to equipment for typical rooms, on a graph, which also shows, noise criteria (NC) curves.

- E. Where sound levels are required in dbA, measure sound levels using the A-frequency-weighting of meter. Single value readings will be used instead of octave band analysis.
- F. Measure sound levels at each octave band as NC or RC (room criteria) if indicated in the Drawings or other Spec Sections. Where measured sound levels exceed specified level, CONTRACTOR shall take all remedial action and necessary sound tests shall be repeated. Sound tests after remedial action shall be in octave band in NC or RC for the room and also at each diffuser, grille, or register in occupied areas. Sound levels shall be measured approximately five feet above floor on a line approximately 45 degrees to center of opening, on the A- and C-frequency-weighting of the measuring instrument.
- G. Measure and record sound levels in decibels for each room per current ANSI S12.60.
- H. Report shall include ambient sound levels, taken without air-handling equipment operating, of rooms in which above openings are located. A report shall also be made of any noise caused by mechanical vibration.

END OF SECTION

SECTION 01 7418
WATER POLLUTION CONTROL
FOR PROJECTS WITH LAND DISTURBANCE OF LESS THAN ONE ACRE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Control runoff and pollutants from the site during construction activities.
2. Preparation, implementation, and maintenance of construction BMPs.

B. Related Requirements:

1. Division 01 – General Requirements.

1.02 ACRONYMS AND DEFINITIONS

BMP	Best Management Practice.
CAN	Corrective Action Notice.
CASQA	California Stormwater Quality Association.
CGP	NPDES General Permit for Storm Water Discharges Associated with Construction Activities.
DWQ	Division of Water Quality.
LARWQCB	Los Angeles Regional Water Quality Control Board.
NPDES	National Pollutant Discharge Elimination System.
OEHS	LAUSD Office of Environmental Health and Safety.
SWPPP	Storm Water Pollution Prevention.
SWRCB	State Water Resources Control Board.
WPCD	Water Pollution Control Drawing.

1.03 REQUIREMENTS

A. CONTRACTOR shall:

1. Implement, install and maintain BMPs. Ensure that BMPs are designed to protect all exposed portions of the site, including:
 - a. Erosion, Sediment, Tracking, and Wind Erosion Control BMPs.
 - b. Preservation of natural features, vegetation, soil, and buffers around surface waters.

- c. Drainage swales or lined ditches to control stormwater flow.
 - d. Mulching or hydroseeding to stabilize disturbed soils.
 - e. Erosion control to protect slopes.
 - f. Protection of storm drain inlets (gravel bags or catch basin inserts).
 - g. Perimeter sediment control (perimeter silt fence, fiber rolls).
 - h. Sediment trap or sediment basin to retain sediment on site.
 - i. Stabilized construction exits.
2. Implement Good Site Management "Housekeeping" BMPs to manage construction equipment, materials, non-stormwater discharges, and wastes. BMPs that should be considered for implementation as appropriate for each project include, but are not limited to, the following:
- a. Dewatering activities.
 - b. Material handling and waste management.
 - c. Building materials stockpile management.
 - d. Management of washout areas (concrete, paints, stucco, etc.).
 - e. Control of vehicle/equipment fueling to staging area.
 - f. Vehicle and equipment cleaning performed off site.
 - g. Spill prevention and control.
3. Incorporate BMP activities into the Project Schedule. Schedule construction activity during dry weather, when possible.
4. Inform CONTRACTOR and Subcontractors personnel on the BMP procedures to prevent pollutants from entering the storm drain system, before the start of construction activities. Keep personnel informed of the BMP implementation process and of changes to the procedures. Provide record to OAR of stormwater topics discussed.
5. Conduct site inspections, at least weekly, of pollution prevention controls and repair or provide additional BMPs as required.
6. Pay fines and penalties from regulatory agencies against OWNER due to CONTRACTOR'S non-compliance with stormwater regulations. OWNER shall recover costs of fines and penalties by appropriate OWNER assessment. Review of the BMPs by OAR shall not relieve CONTRACTOR from liabilities arising from non-compliance of storm water pollution regulations.
- B. Project Inspector and OEHS Inspector will conduct inspection and examination of site storm water regulation compliance.
- C. At substantial completion, conduct post-construction BMP training of OWNER personnel and submit any post-construction BMP maintenance information.

1.04 SUBMITTALS

- A. BMP material quality, grade, type as specified in the CASCA BMP Handbook.
- B. Water Pollution Control Drawing (WPCD).
- C. BMP Implementation Schedule.

1.05 QUALITY ASSURANCE

- A. Comply with the following regulatory requirements:
 - 1. National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Lands Disturbance Activities; ORDER NO. 2009-0009-DWQ; NPDES NO. CAS000002, adopted by the State Water Resources Control Board.
 - 2. Regulations of the California Environmental Protection Agency, State Water Resources Control Board; Los Angeles Regional Water Control Board, and local ordinances.
 - 3. CASQA Stormwater Best Management Practice Handbook for Construction Activity (BMP Handbook) current adopted edition.
 - 4. Local jurisdiction stormwater management (SWPPP) and erosion control ordinances.

1.06 STORAGE AND PROTECTION

- A. Provide proper storage of materials and equipment to prevent rain and storm water runoff to come in contact with pollutants, such as soil stabilizers, paint or fluids from vehicles.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Provide quality, grade and type of materials as specified in CASQA Stormwater Best Management Practice, Handbook.

PART 3 – EXECUTION

3.01 IMPLEMENTATION

- A. Install perimeter controls prior to starting Work at the Project site.
- B. Contain on-site stormwater on the Project site. Provide storm drain inlet protection. Do not drain on-site water directly into the storm drain without proper BMP in place.
- C. Prevent pollutant discharges into the storm drain system. Prevent stormwater from coming into contact with pollutants, such as sediment, material spills, or leakage from

storage tanks, waste containers or transfer areas. In the event contamination is found CONTRACTOR shall immediately notify OAR who will contact the OEHS.

- D. Protect exposed dirt, such as stockpiles, landscaping areas, and hillsides.
- E. Properly manage non-stormwater discharges such as ground water, broken utility lines and fire hydrant testing.
- F. Adjust BMP's locations and layouts in accordance to construction progress to assure compliance to regulations.
- G. Conduct inspections of pollution prevention controls and provide Site Monitoring Report to OAR immediately if pollutants are discharged into the site runoff. CONTRACTOR shall remediate contaminated water.
- H. Upon Substantial Completion: Maintain and leave post-construction stormwater pollution prevention controls in place and remove those that are not needed as determined by the OAR.

3.02 CLOSEOUT

- A. Verify the following prior to Substantial Completion:
 - 1. Final stabilization of site has been demonstrated.
 - 2. There is no potential for construction related stormwater pollutants to be discharged into site runoff.
 - 3. Construction related equipment and temporary BMP have been removed from site.
 - 4. Rubbish, debris, and waste materials have been removed and legally disposed of off the Project site.
 - 5. OEHS CAN items have been closed and signed-off.
 - 6. Post-Construction BMP Maintenance Plan has been established.

END OF SECTION

SECTION 01 7700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section includes administrative and procedural requirements for Contract Closeout, including but not limited to, the following:
1. Inspection procedures.
 2. Project record documents submittal.
 3. Operation and maintenance manual submittal.
 4. OWNER orientation and instruction.
 5. Final cleaning.

1.02 RELATED REQUIREMENTS:

1. Section 01 2976 - Progress Payment Procedures.
2. Section 01 3213 - Construction Schedule.
3. Section 01 3229 - Project Forms.
4. Section 01 3300 - Submittal Procedures.
5. Section 01 4525- Testing, Adjusting, and Balancing of HVAC.
6. Section 01 5000 - Construction Facilities and Temporary Controls.
7. Section 01 7836 - Warranties.

PART 2 – PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 SUBSTANTIAL COMPLETION

- A. Inspection Procedures: On receipt of the Request For Certificate of Substantial Completion, OAR will authorize commencement of inspection. INSPECTOR, OAR, CONTRACTOR and ARCHITECT will inspect the Work.
 - 1. If after inspection of the Work, OAR does not consider the Work substantially complete, OAR will notify CONTRACTOR.
 - 2. If after inspection, OAR considers the Work substantially complete, INSPECTOR shall prepare a comprehensive Punch List of items to be corrected.
 - a. INSPECTOR may repeat inspection to assure the Work is corrected.
 - b. Results of the completed inspection will form a partial basis of the requirements for Release of Retention.

3.02 ADMINISTRATIVE CLOSEOUT

- A. Re-inspection Procedures: INSPECTOR, OAR, CONTRACTOR and ARCHITECT may inspect the Work upon notice, including final inspection of Punch List items from earlier inspections, has been corrected, except for items whose completion is delayed under circumstances acceptable to OAR.
 - 1. OWNER has the right to preclude CONTRACTOR from Punch List correction and documents submittals after the Contract Completion date; unless OWNER elects to authorize CONTRACTOR to extend Administrative Contract duration. CONTRACTOR will be assessed actual cost for the unsettled items. Withholds amounts exceeding actual costs to correct or to obtain deliverable will be released.
 - 2. If allowed by the OAR, re-inspection will be repeated, but may be assessed against CONTRACTOR if OWNER is subject to additional professional service and or additional costs of inspection.

3.03 PROJECT RECORD DOCUMENT SUBMITTAL

- A. General: Do not use project record documents for construction purposes. Protect record documents from deterioration and loss. Provide access to record documents for ARCHITECT, INSPECTOR and OAR reference during normal working hours. Project record document shall be updated on a weekly basis. Prior to submitting each application for payment, secure INSPECTOR and ARCHITECT approval of project record documents.
- B. Record Drawings: Maintain a clean, undamaged set of prints of Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark the Drawing that is

most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Drawings. Provide detailed and accurate field dimensions for concealed elements that would be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work. Date and number entries in the same format as submitted. Call attention to entry by a “cloud” around the affected areas.
 2. Mark new information important to OWNER but was not shown on Drawings or Shop Drawings.
 3. Utility location and depth below finished grade and above ceilings and attic spaces shall be fully dimensioned and indicated on record drawings. Dimensions shall be measured from building lines or permanent landmarks and shall be triangulated to those features.
 4. Note related Change Order or Construction Directive numbers where applicable. RFC submissions shall be referenced on each affected sheet, Drawing and Shop Drawing.
 5. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.
 6. Prior to Contract Completion of the Work, review of the project record drawings by ARCHITECT; prepare a final set of project record drawings using reproducible vellum. Submit final set of transparencies to ARCHITECT.
- C. Record Specifications: Maintain two complete copies of the Specifications, including Addenda. Include with the Specifications two copies of other written Contract Documents, such as Change Orders or Construction Directives issued during construction.
1. Mark these record documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.
 2. Give particular attention to substitutions and selection of options and information on concealed Work that cannot otherwise be readily discerned later by direct observation.
 3. Note related record document information with Product Data.

4. Prior to Contract Completion of the Work, submit record Specifications to ARCHITECT for OWNER records.
- D. Record Product Data: Maintain two copies of each Product Data submittal. Note related Change Orders and Construction Directives and mark-up of record drawings and Specifications.
1. Mark these documents to illustrate significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the Project site and from the manufacturer's installation instructions and recommendations.
 2. Provide detailed and accurate information regarding concealed products and portions of Work that cannot otherwise be readily discerned later by direct observation.
 3. Prior to Contract Completion, submit complete set of record Product Data to ARCHITECT for OWNER records.
- E. Record Samples: Immediately prior to Substantial Completion, CONTRACTOR shall meet with ARCHITECT and OAR at the Project site to determine which Samples are to be transmitted to OWNER for record purposes. Comply with OAR instructions regarding delivery to OWNER storage area.
- F. Miscellaneous Records: Refer to other Specification sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Prior to the date of Contract Completion, complete and compile miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to Architect for OWNER records.
- G. Maintenance Manuals: Prior to Substantial Completion, organize operation and maintenance data into suitable two sets of manageable size. Bind properly indexed data in individual, heavy-duty, two to three-inch 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Submit to ARCHITECT for OWNER records. Include the following types of information.
1. Emergency instructions.
 2. Spare parts list.
 3. Copies of warranties.
 4. Wiring diagrams.
 5. Recommended "turn-around" cycles.

6. Inspection procedures.
 7. Shop Drawings and Product Data.
 8. Fixture lamping schedule.
- H. Verified Reports: Construction progress of the Work shall be reported to DSA via a duly verified report as per Title 24, Part 1, Sections 4-336 and 4-343.c of the California Building Standards Commission's, California Administrative Code.

3.04 OPERATION AND MAINTENANCE:

- A. Operation and Maintenance Instructions: Prior to Substantial Completion, arrange for each installer of equipment that requires regular operation and maintenance to meet with designated OWNER personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:
1. Maintenance manuals.
 2. Spare parts and materials.
 3. Tools.
 4. Lubricants.
 5. Fuels.
 6. Identification systems.
 7. Control sequences.
 8. Hazards.
 9. Cleaning.
 10. Warranties and bonds.
 11. Maintenance agreements and similar continuing commitments.
- B. As part of instruction for operating equipment, demonstrate the following procedures:
1. Start-up.
 2. Shutdown.

3. Emergency operations.
 4. Noise and vibration adjustments.
 5. Safety procedures.
 6. Economy and efficiency adjustments.
 7. Effective energy utilization.
- C. Notice Of Termination: CONTRACTOR shall submit a Notice of Termination (NOT) to the local Regional Water Quality Control Board, RWQCB. Provide a copy of NOT to OAR.

3.05 FINAL CLEANING

- A. General: Related sections of the Contract Documents specify general cleaning during performance of the Work. General cleaning is included in Division 01 Section "Construction Facilities and Temporary Controls".
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
1. Complete the following cleaning operations before requesting inspection for a certificate of Substantial Completion.
 - a. Remove labels that are not permanent labels.
 - b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
 - c. Clean exposed exterior and interior hard-surfaced finished to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
 - d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
 - e. Clean the Project site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits.

Rake grounds that are neither paved nor planted to a smooth, even-textured surface.

END OF SECTION

SECTION 01 7329
CUTTING AND PATCHING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section specifies procedural requirements for cutting and patching.

1.02 RELATED REQUIREMENTS

- A. Section 01 2973 - Schedule of Values.
- B. Section 01 3113 - Project Coordination.
- C. Section 01 3119 - Project Meetings.
- D. Section 01 3213 - Construction Schedule.
- E. Section 01 3300 - Submittal Procedures.
- F. Section 01 7123 - Field Engineering.
- G. Section 01 7836 - Warranties.
- H. Section 01 4525 - Testing, Adjusting, and Balancing of HVAC.

1.03 SUBMITTALS

- A. The word “cutting” as used in the Contract Documents includes, but is not limited to, cutting, drilling, chopping, and other similar operations and the word “patching” includes, but is not limited to, patching, rebuilding, reinforcing, repairing, refurbishing, restoring, replacing, or other similar operations.
- B. Cutting and Patching Proposal: CONTRACTOR shall submit a proposal describing procedures well in advance of the time cutting and patching will be performed if the Contract Documents requires approval of these procedures before proceeding. Include the following information, as applicable, in the proposal:

1. Describe the extent of cutting and patching required. Denote how it will be performed and indicate why it cannot be avoided.
2. Describe anticipated results in terms of changes to existing construction. Include changes to structural elements and operating components as well as changes in the building's appearance or other significant visual elements.
3. List products to be used and firms or entities that will perform this Work.
4. Indicate dates when cutting and patching will be performed.
5. Utilities: List utilities that cutting and patching operations will disturb or affect. List utilities to be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
6. Where cutting and patching involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the original structure.
7. Review by ARCHITECT and DSA prior to proceeding with cutting and patching does not waive ARCHITECT right to later require complete removal and replacement of defective Work.

1.04 QUALITY ASSURANCE

- A. Requirements for structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.
 1. Obtain approval from ARCHITECT and DSA of the cutting and patching proposal before cutting and patching the following structural elements:
 - a. Foundation construction.
 - b. Bearing and retaining walls.
 - c. Structural concrete.
 - d. Structural steel.
 - e. Lintels.
 - f. Timber and primary wood framing.
 - g. Structural decking.
 - h. Stair systems.

- i. Miscellaneous structural metals.
 - j. Exterior curtain-wall construction.
 - k. Equipment supports.
 - l. Piping, ductwork, vessels, and equipment.
 - m. Structural systems of special construction in Division 13 Sections.
- B. Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.
- 1. Obtain review of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
 - a. Primary operational systems and equipment.
 - b. Air or smoke barriers.
 - c. Water, moisture, or vapor barriers.
 - d. Membranes and flashings.
 - e. Fire protection systems.
 - f. Noise and vibration control elements and systems.
 - g. Control systems.
 - h. Communication and/or data systems.
 - i. Conveying systems.
 - j. Electrical wiring systems.
 - k. Operating systems of special construction in Division 13 Sections.
- C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the opinion of ARCHITECT, reduce the building's aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

1. If possible, retain the original installer or fabricator to cut and patch the exposed Work listed below. If it is impossible to engage the original installer or fabricator, engage another recognized experienced and specialized firm.
 - a. Firestopping.
 - b. Acoustical ceilings.
 - c. Acoustical panels.
 - d. Finished wood flooring.
 - e. Synthetic sports flooring.
 - f. Carpeting.
 - g. HVAC enclosures, cabinets, or covers.
 - h. Ceramic and quarry tile.
 - i. Gypsum board.
 - j. Masonry (exterior and interior where exposed).
 - k. Tack boards.
 - l. Casework.
 - m. Finish carpentry.

1.05 WARRANTY

- A. Existing Warranties: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.

1. Before proceeding, meet at the Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.02 PREPARATION

- A. Temporary support: Provide adequate temporary support of existing improvements or Work to be cut.
- B. Protection: Protect existing improvements and Work during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of existing improvements or Work that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Where the Work requires sandblasting of existing surfaces in order to receive new materials secured by cementitious, adhesive or chemical bond, completely remove existing finishes, stains, oil, grease, bitumen, mastic and adhesives or other substances deleterious to the new bonding or fastening of new Work. Utilize wet sand blasting for interior surfaces and for exterior surfaces where necessary to prevent objectionable production of dust.

3.03 PERFORMANCE

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay. Carefully remove existing Work to be salvaged and/or reinstalled. Protect and store for reuse into the Work. Verify compatibility and suitability of existing substrates before starting the Work.
- B. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining Work. Where possible, review proposed procedures with the original installer; comply with the original installer's recommendations.
 1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
 3. Cut through concrete and masonry using a cutting machine, such as a carborundum saw or a diamond-core drill. Saw cut reinforcing bars and

paint ends with bituminous paint except where bonded into new concrete or masonry.

4. Comply with requirements of applicable Sections of Divisions 31, 32, and 33 where cutting and patching requires excavating, backfill, and re-compaction.
 5. Woodwork: Cut and or remove to a panel or joint line.
 6. Sheet Metal: Remove back to joint, lap, or connection. Secure loose or unfastened ends or edges and seal watertight.
 7. Glass: Remove cracked, broken, or damaged glass and clean rebates and stops of setting materials.
 8. Plaster: Cut back to sound plaster on straight lines, and back bevel edges of remaining plaster. Trim existing lath and prepare for new lath.
 9. Gypsum Wallboard: Cut back on straight lines to undamaged surfaces with at least two opposite cut edges centered on supports.
 10. Acoustical ceilings: Remove hanger wires and related appurtenances where ceilings are not scheduled to be installed.
 11. Tile: Cut back to sound tile and backing on joint lines.
 12. Flooring: Completely remove flooring and clean backing of prior adhesive. Carefully remove wood flooring for patching and repairing of existing wood flooring scheduled to remain.
- C. Patching: Patch with durable seams that are as invisible as possible. Comply with required tolerances.
1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation. Verify conditions of existing substrates prior to executing Work.
 2. Restore exposed finishes of patched areas and extend finish restoration into retaining adjoining construction in a manner that will eliminate all evidence of patching and refinishing.
 3. Concrete: Maintain cut edges in a moist condition for twenty four hours prior to the placement of new concrete. In lieu of this an epoxy adhesive may be provided. Finish placed concrete to match existing unless noted otherwise. Concrete shall have a compressive strength of 3,000 psi where installed to repair and match existing improvements, unless noted otherwise.

4. Metal Fabrications: Items to remain exposed shall have their edges cut and ground smooth and rounded.
5. Sheet Metal: Replace removed or damaged sheet metal items for new Work.
6. Glass: Install matching glass and re-seal exterior window assemblies.
7. Lath and Plaster: Install new lath materials to match existing and fasten to supports at 6-inch centers. Provide a 6-inch lap where new lath to adjoins existing lath. Fasten new lath as required for new Work. Restore paper backings as required. Apply a bonding agent on cut edges of existing plaster. Apply three coat plaster of the type, thickness, finish, texture, and color to match existing.
8. Gypsum Wallboard: Fasten cut edges of wallboard. Install patches with at least two opposite edges centered on supports and secure at 6-inch centers. Tape and finish joints and fastener heads. Patching shall be non-apparent when painted or finished.
9. Acoustical Ceilings: Comply with the requirements for new Work specified in related sections of the Contract Documents.
10. Resilient Flooring: Completely remove flooring and prepare substrate for new material.
11. Painting: Prepare areas to be patched, patch and paint as specified under related sections of the Contract Documents.

3.04 CLEANING

- A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged coverings to their original condition.

END OF SECTION

SECTION 01 7900

MAINTENANCE AND OPERATIONS & COMMUNITY SERVICES DEPARTEMENT
STAFF DEMONSTRATION AND TRAINING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Administrative and procedural requirements for training OWNER's personnel.
 - 1. Demonstration of operations of systems, subsystems and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.

1.02 RELATED REQUIREMENTS

- A. Project Commissioning Plan (C&P).
- B. CHPS Best Practices Manual.
- C. CAL/OSHA Minimum Ventilation Standard, Title 8, Section 5142.
- D. California Building Code, Chapter 12.
- E. Division 01 - General Requirements.
- F. Division 22 - Plumbing.
- G. Division 23 – Heating Ventilating and Air Conditioning.
- H. Division 26 - Electrical.
- I. Division 27 – Communications.

1.03 SUBMITTALS

- A. Submittals, including training modules, require the Commissioning Services Provider's (CxSP) review and OAR acceptance prior to implementation.
- B. Upon completion of training, submit two complete training manuals for OWNER's use including materials in the complete training manual in the Adobe PDF format. Each manual shall contain specific training and instruction manuals and hand-outs for the following designated end-users:

1. OWNER Maintenance and Operations (M&O) Personnel.
 2. OWNER Community Services Department Personnel
- C. Demonstration and Training Video: CONTRACTOR shall video record each training and demonstration session and submit a copy at end of each training module. CONTRACTOR shall include a copy of manufacturer training video materials presented during training and demonstration session.

1.04 COORDINATION

- A. Coordinate instruction schedule with the OAR, CxSP, and OWNER's M&O personnel. Adjust schedule as required to reasonably accommodate the schedules of participants and to minimize disrupting OWNER operations.
- B. Coordinate with instructors, including providing notification of scheduled dates, times, length of instruction time and course content.
- C. Coordinate content of training modules with content of approved Emergency Manual and Operations and Maintenance Manual. Do not submit instruction program until manual has been reviewed and accepted by the OAR.

1.05 INSTRUCTION PROGRAM

- A. Program Structure: Develop instruction program that includes individual demonstration and training modules for the operation, maintenance, minor repair (completion in under two hours) and calibration of systems and components in the system as required by Section 01 9113, Divisions 22, 23 and Division 26 and as specified in Part 3 of this Section, "DEMONSTRATION AND TRAINING".
- B. For each module, include instruction for the following:
 1. Basis of System Design (for OWNER Operations and Maintenance Personnel), Operational Requirements and Criteria, including, but not limited to:
 - a. System, subsystem and equipment descriptions.
 - b. Performance and design criteria if CONTRACTOR is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.

- g. Limiting conditions.
 - h. Performance curves.
2. Documentation (for OWNER) Review in detail the following documentation:
- a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project Record Documents.
 - e. Identification systems.
 - f. Warranties.
 - g. Maintenance service agreements and similar continuing commitments.
3. Emergencies (for OWNER): Review, without limitation, the following, as applicable:
- a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
4. Operations (for OWNER): Review, without limitation, the following as applicable:
- a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.

- f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for system, subsystem or equipment failure.
 - j. Seasonal and weekend operating instructions.
 - k. Required sequences for electric or electronic systems.
 - l. Special operating instructions and procedures.
5. Adjustments (for OWNER): Review, without limitation, the following as applicable:
- a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting (for OWNER): Review, without limitation, the following as applicable:
- a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance (for OWNER): M&O Review, without limitation, the following, as applicable:
- a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning.
 - e. Procedures for preventative maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.

8. Repairs (for OWNER): Review, without limitation, the following as applicable:
 - a. Diagnostic instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair and replacement and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of parts needed for operation and maintenance.

1.06 PREPARATION

- A. Training Facilitator: Engage qualified training facilitator no later than 120 days prior to start of training to prepare instruction program and training modules, to coordinate instructors, and to coordinate between CONTRACTOR, OAR and CxSP for number of participants, instruction times and location.
- B. Training Instructor: Engage qualified training instructors to instruct OWNER's personnel to adjust, operate and maintain systems, subsystems and equipment not part of a system no later than 30 days prior to start of training of assigned modules.
- C. Scheduling: Provide instruction at mutually agreed on times.
 1. Schedule training with OWNER, through OAR, with at least two weeks advance notice.
 2. Schedule training to conform to personnel availability at Site.
 3. Conduct training(s) after the execution of commissioning Pre-functional and Functional Tests are completed.
 4. Base duration of training on hours specified in the applicable specifications or minimums defined in Article 1.08.
- D. Familiarize OWNER staff regarding CAL/OSHA Title 8, section 5142 Requirements.

1.07 OPERATIONS AND MAINTENANCE MANUALS

- A. CONTRACTOR shall direct Subcontractors to compile and prepare M&O Manuals and other required documentation for the equipment and systems that are provided and/or installed per their scope of work for submittal to OAR prior to project closeout.
- B. The OAR shall receive a copy of the Operations and Maintenance manuals prior to initiation of demonstration and training for review and acceptance or rejection.

- C. Operations and Maintenance manuals shall meet the respective requirements of Divisions 22,23 and Division 26; and comply with the following:
1. Quantity: Two.
 2. Format: 8 ½ by 11 loose leaf binders. Each binder shall be clearly labeled on the spine and meet the requirements of Section 01 7700. Dividers shall be made of card stock with permanently marked index tabs to separate each section and sub section. Tab labels shall not be handwritten. Binders will meet other formatting requirements as outlined in DIVISIONS 02 to 49, as applicable.
 3. Contents: There shall be a title page and table of contents at the beginning of each binder. The table of contents shall be an outline that identifies the equipment or systems documentation included in the binder and references the specification sections relating to the equipment and systems that are being included in each part of the binder. Each part of the binder shall contain the information described below, in the following order.
 - a. CONTRACTOR. The first page shall contain the name, address, and telephone number of the manufacturer and installing CONTRACTOR, as well as the 24-hour number for emergency service for each piece of equipment identified in this section.
 - b. Preventive Maintenance Instructions. This section shall list the location of preventative maintenance instructions. The list shall show the piece of equipment, the Operations and Maintenance document name, and the O&M document page number that contains the instructions.
 - c. Submittal and Product Data. This section shall include product data not covered by manufacturer's Operations and Maintenance instructions and associated shop drawings.
 - d. Warranty and Service Contracts. This section shall include the following for each piece of equipment, as applicable:
 - 1) Copy of the equipment warranty information provided as part of Section 01 7836.
 - 2) Additional Warranties in accordance with Warranty requirements in DIVISIONS 02 to 49, as applicable. Equipment Warranties shall clearly list requirements to maintain the Warranty in effect, conditions or acts that would invalidate or void the Warranty, and Warranty expiration date.
 - 3) Service contracts issued. Contracts shall clearly indicate contract dates and scope of work included.

- e. Operation and Maintenance Instructions. These shall be the written manufacturer's maintenance and operating instructions with the model number and features of the installed equipment or system clearly identified. This section shall include applicable data on the following:
 - 1) Installation, startup, and break-in instructions.
 - 2) Starting, normal shutdown, emergency shutdown, manual operation, seasonal changeover and normal operating procedures and data, including any special limitations.
 - 3) Operations and Maintenance and installation instructions that were shipped with the unit.
 - 4) Preventative maintenance and service procedures and schedules.
 - 5) Troubleshooting procedures.
 - 6) A parts list, edited to omit reference to items which do not apply to this installation.
 - 7) A list of any special tools required to service or maintain the equipment.
 - 8) Performance data, ratings, and curves.
- f. Control Drawings. This section contains controls drawings and the final sequence of operations, set points, and schedules as set during the Commissioning Process. If shop drawings, portions of the project manual, or record drawings clearly show this information, a copy of this information may be inserted. Otherwise, original drawings shall be generated and included in this section.

D. Division 23 Special Water and Air Balance Documentation. The Balancing Subcontractor will compile and submit the following with other documentation that may be specified elsewhere in the Project Specifications.

- 1. Final report containing an explanation of the methodology, assumptions, test conditions, and the results in a clear format with designations of all uncommon abbreviations and column headings.
- 2. The Balancing Subcontractor shall mark on the drawings where all traverse and other critical measurements were taken and cross reference the location in the Test and Balance report.

1.08 DEMONSTRATION AND TRAINING SCHEDULE

- A. The following applies to the minimum duration of demonstration and training provided City of Hermosa Beach Maintenance Division and Community Services Department Personnel.
1. Heat Generation:
 2. Water Distribution Piping: Minimum Refrigerant Systems:
 - a. Condensers
 - b. Pumps
 - c. Distribution Piping
 3. HVAC Systems:
 - a. Air-handling Equipment:
 - b. Air Distribution Systems
 4. HVAC Instrumentation and Controls
 5. Lighting Systems and Controls

PART 2 – PRODUCTS – N/A

PART 3 – EXECUTION – N/A

END OF SECTION

SECTION 01 4523
TESTING AND INSPECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Testing and inspection services to meet requirements of the California Building Code (CBC).
- B. Related Requirements:
 - 1. Section 03 2000 – Concrete Reinforcing.
 - 2. Section 03 3000 – Cast-in-Place Concrete.
 - 3. Section 04 2200 – Concrete Unit Masonry.
 - 4. Section 05 1200 – Structural Steel Framing.
 - 5. Section 06 1000 – Rough Carpentry.

1.02 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 318 – Building Code Requirements for Structural Concrete and Commentary.
- B. American Institute of Steel Construction (AISC):
 - 1. AISC 360 – Specification for Structural Steel Buildings.
 - 2. AISC 341 – Seismic Provisions for Structural Steel Buildings.
- C. ASTM International (ASTM):
 - 1. ASTM A108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
 - 2. ASTM A370 – Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
 - 3. ASTM A706 – Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.

4. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
5. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
6. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
7. ASTM C1140 - Standard Practice for Preparing and Testing Specimens from Shotcrete Test Panels.
8. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.
9. ASTM C1604 - Standard Test Method for Obtaining and Testing Drilled Cores of Shotcrete.
10. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments.
11. ASTM E488 - Standard Test Methods for Strength of Anchors in Concrete Elements.
12. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing.
13. ASTM E605 - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.
14. ASTM E1444 - Standard Practice for Magnetic Particle Testing.
15. ASTM F606 - Standard Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets.

D. Association of the Wall and Ceiling Industry (AWCI):

1. AWCI Technical Manual 12-B - Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-Resistive Materials; an Annotated Guide.

E. American Welding Society (AWS):

1. AWS D1.1 – Structural Welding Code.
2. AWS D1.4 – Structural Welding Code – Reinforcing Steel.
3. AWS D1.8 – Structural Welding Code – Seismic Supplement.

1.03 REGULATORY REQUIREMENTS

- A. Laboratories performing testing shall have the City of Hermosa Beach approval prior to providing material testing or special inspection services.
- B. Tests of materials and inspections shall be in accordance to Section 4-213 through 4-219 of the California Building Standards Commission's, California Administrative Code.
- C. Required material testing, inspections and special inspections are indicated on the Building Permit issued by the City of Hermosa Beach.

1.04 TESTS

- A. OWNER will contract with an approved testing laboratory to perform the testing indicated on the Contract Documents, including the Tests and Special Inspections (T&I) list.
- B. Selection of material to be tested shall be by the Testing Laboratory and not by CONTRACTOR.
- C. Any material shipped from the source of supply prior to having satisfactorily passed such testing and inspection, or prior to the receipt of notice from Project Inspector such testing and inspection is not required, shall not be incorporated into the Work.
- D. OWNER will select, and directly reimburse, the Testing Laboratory for costs of all required tests and inspections.
- E. The Testing Laboratory is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.
- F. The Testing Laboratory shall not perform any duties of CONTRACTOR.

1.05 TEST REPORTS

- A. Test reports shall include all tests performed, regardless of whether such tests indicate the material is satisfactory or unsatisfactory. Samples taken but not tested shall also be reported. Records of special sampling operations, when and as required, shall also be reported. Reports shall indicate the material (or materials) was sampled and tested in accordance with requirements of CBC, Title 24, Parts 1 and 2, as indicated on the Contract Documents. Test reports shall indicate specified design strength and specifically state whether or not the material (or materials) tested comply with the specified requirements.

1.06 VERIFICATION OF TEST REPORTS

- A. Each Testing Laboratory shall submit to the City of Hermosa Beach , in duplicate, a verified report covering all tests required to be performed by that agency during the progress of the Work. Such report, covering all required tests, shall be furnished prior to Substantial Completion and/or, when construction on the Work is suspended, covering all tests up to the time of Work suspension.

1.07 INSPECTION BY OWNER

- A. OWNER, and its representatives, shall have access, for purposes of inspection, at all times to all parts of the Work and to all shops wherein the Work is in preparation. CONTRACTOR shall, at all times, maintain proper facilities and provide safe access for such inspection.
- B. OAR shall have the right to reject materials and/or workmanship deemed defective Work and to require correction. Defective workmanship shall be corrected in a satisfactory manner and defective materials shall be removed from the premises and legally disposed of without charge to OWNER. If CONTRACTOR does not correct such defective Work within a reasonable time, fixed by written notice and in accordance with the terms and conditions of the Contract Documents, OWNER may correct such defective Work and proceed in accordance with related Articles of the Contract Documents.
- C. CONTRACTOR is responsible for compliance to all applicable local, state, and federal regulations regarding codes, regulations, ordinances, restrictions, and requirements.

1.08 PROJECT INSPECTOR

- A. A Project Inspector will be employed by the City of Hermosa Beach in accordance with requirements of Title 24 of the California Code of Regulations with their duties specifically defined therein.
- B. Inspection of Work shall not relieve CONTRACTOR from any obligation to fulfill all terms and conditions of the Contract Documents.
- C. CONTRACTOR shall be responsible for scheduling times of inspection, tests, sample taking, and similar activities of the Work.

1.09 STRUCTURAL TESTS AND SPECIAL INSPECTIONS

- 1. Retaining Walls:
 - a. Continuous inspections by Geotechnical Engineer:

- 1) Placement, compaction and inspection of soil per CBC Section 1705A.6.1 for fills supporting foundations.
 - 2) Segmental retaining walls; inspect placement of units, dowels, connectors, etc.
- b. Concrete Retaining Walls: Provide tests and inspections as indicated on paragraphs below for concrete.
 - c. Masonry Retaining Walls: Provide tests and inspections as indicated on paragraphs below for masonry.
- A. Concrete:
1. Cast in Place Concrete: Inspection and testing in conformance to CBC Table 1705A.3:
 - a. Inspection of reinforcement, including prestressing tendons and verification of placement, per ACI 318, sections 25.2, 25.2, 25.5.1 through 26.5.3.
 - b. Reinforcing bar welding: Inspect per AWS D1.4, ACI 318 26.5.4.
 - 1) Verification of weldability of reinforcing bars other than ASTM A706.
 - 2) Inspect single-pass fillet welds, maximum 5/16".
 - 3) Inspect all other welds.
 - c. Inspect anchors cast in concrete per ACI 318, section 17.8.2.
 - d. Inspect anchors post-installed in hardened concrete members:
 - 1) Continuous inspection of adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads, per ACI 318, section 17.8.2.4.
 - 2) Mechanical anchors and adhesive anchors, not defined in previous paragraph, per ACI 318, section 17.8.2.
 - e. Design Mix:
 - 1) Verify use of required mix, per ACI 318, chapter 19 and sections 26.4.3 and 26.4.4.
 - 2) Batch Plant Inspection: The quality and quantity of materials used in transit-mixed concrete and in batched

aggregates shall be continuously inspected as required by CBC section 1705A.3.2. If approved by DSA, batch plant inspection may be reduced to periodic if plant complies with CBC section 1705A.3.3.1, item 1, and requires first batch inspection, weightmaster, and batch tickets.

- f. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete, per ASTM C172, ASTM C31, ACI 318, sections 26.4.5 and 26.12.
 - g. Inspect concrete and shotcrete placement for proper application techniques, per ACI 318, section 26.4.5.
 - h. Verify maintenance of specified curing temperature and techniques per ACI 318 sections 26.4.7 through 26.4.9 and CBC section 1908.9.
 - i. Inspect prestressed concrete for:
 - 1) Application of prestressing forces, per ACI 318 section 26.9.2.1
 - 2) Grouting of bonded prestressing tendons per ACI 318 section 26.9.2.3.
 - j. Inspection of erection of precast concrete members per ACI 318 chapter 26.8.
 - k. Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs per ACI 318 section 26.10.1.b.
 - l. Sampling and testing of reinforcing steel per ASTM A370, DSA IR 17-10 and CBC section 1910A.2. CONTRACTOR shall submit mill certificate indicating compliance with requirements for reinforcement, anchors, ties, and metal accessories.
2. Post-installed Anchors:
- a. Special Inspector will inspect installation of post-installed anchors in hardened concrete members as required by CBC table 1705A.3, item 4.
 - 1) Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads, per ACI 318, section 17.8.2.4.

2) Mechanical anchors and adhesive anchors not defined above, per ACI 318, section 17.8.2.

b. Testing Laboratory will test post-installed anchors in conformance to CBC section 1905A and ASTM E488.

B. Structural Masonry:

1. Material Verification and Testing:

a. Sampling and testing of reinforcing steel per ASTM A370, DSA IR 17-10 and CBC section 1910A.2. CONTRACTOR shall submit mill certificate indicating compliance with requirements for reinforcement, anchors, ties, and metal accessories.

b. Submit manufacturer's certificate of compliance for masonry units, mortar and grout materials. Test masonry units, mortar and grout (unit strength method).

c. Testing Laboratory will test masonry prisms in conformance with ASTM C1314.

d. Special Inspector will verify proportions of site-prepared, premixed or preblended mortar and grout, per ASTM C780.

e. Testing Laboratory will test core-drilled samples in conformance with CBC 2114.6.2.

2. Inspection:

a. Special Inspector will continuously inspect preparation of prisms per ASTM C1314.

b. Special inspector will verify size, location and condition of dowels and construction supporting masonry.

c. Special inspector will verify size specified size, grade and type of reinforcement.

d. Special inspector will verify weldability of reinforcing bars other than ASTM A706. Special inspector to inspect reinforcing bar welding: Inspection to be in conformance with AWS D1.4, ACI 318 26.5.4.

e. Special inspector will inspect placement of reinforcement, connectors, masonry units and construction of mortar joints.

- f. Special inspector will verify protection of masonry during cold weather temperature (temperature below 40° F) or hot weather (temperature above 90° F).
 - g. Special inspector will inspect type, size and location of anchors and all other items to be embedded in masonry, including other details of anchorage of masonry to structural members, frames and other construction.
 - h. Special inspector will inspect grout space prior to grouting and placement of grout.
3. Post-installed Anchors in Masonry:
- a. Special inspector will inspect anchors cast in concrete per ACI 318, section 17.8.2.
 - b. Special inspector will inspect anchors post-installed in hardened concrete members:
 - 1) Continuous inspection of adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads, per ACI 318, section 17.8.2.4.
 - 2) Mechanical anchors and adhesive anchors, not defined in previous paragraph, per ACI 318, section 17.8.2.
 - c. Testing Laboratory will test post-installed anchors in conformance to CBC section 1905A and ASTM E488.

C. Structural Steel:

- 1. Special inspector will verify that all materials are properly marked in conformance with AISC 360, Section 3.3 and applicable ASTM standards.
 - a. Mill certificates indicating material properties that comply with requirements.
 - b. Materials, sizes, types and grades complying with requirements.
- 2. Testing Laboratory will test unidentified materials in conformance with ASTM A370.
- 3. Special inspector will examine seam welds of HSS shapes in conformance with DSA IR-17-3.
- 4. Special inspections and non-destructive testing of structural steel elements shall be in conformance to CBC section 1705A.2.1.

D. High Strength Bolts:

1. Special inspector will verify identification markings and manufacturer's certificates of compliance conform to ASTM standards specified in the Contract Documents, per DSA IR 17-9.
2. Testing Laboratory will test high-strength bolts, nuts and washers in conformance with ASTM F606, ASTM A370 and DSA IR 17-8.
3. Special inspector will inspect bearing-type ("snug tight") bolt connections in conformance with AISC 360, section M2.5 and DSA IR 17-9.
4. Special inspector will inspect slip-critical bolt connections in conformance with AISC 360, section M2.5.

E. Welding:

1. Verification of Materials, Equipment and Welders:
 - a. Special inspector will verify weld filler material identification markings per AWS designation listed on the Contract Documents and the WPS.
 - b. Special inspector will verify material manufacturer's certificate of compliance.
 - c. Special inspector will verify WPS, welder qualifications and equipment in conformance to DSA IR 17-3.
2. Shop Welding: Special inspector will inspect the following, per CBC 1705A.2.1, AISC 360 (and AISC 341, as applicable) and DSA IR 17-3:
 - a. Groove, multi-pass fillet welds larger than 5/16", plug and slot welds.
 - b. Single-pass fillet welds equal or less than 5/16".
 - c. Inspect welding of stairs and railing systems.
 - d. Verification of reinforcing steel weldability.
 - e. Welding of reinforcing steel, per AWS D1.4.
3. Field Welding: Special inspector will inspect the following, per CBC 1705A.2.1, AISC 360 (and AISC 341, as applicable) and DSA IR 17-3:
 - a. Groove, multi-pass fillet welds larger than 5/16", plug and slot welds.

- b. Single-pass fillet welds equal or less than 5/16”.
 - c. End welded studs (ASTM A108) installation, including bend test.
 - d. Floor and roof deck welds.
 - e. Welding of structural cold-formed steel.
 - f. Welding of stairs and railing systems.
 - g. Verification of reinforcing steel weldability.
 - h. Inspect welding of reinforcing steel.
4. Non-Destructive Testing: Testing Laboratory will test perform ultrasonic and magnetic particle testing in conformance to AISC 360 section N5.5, AISC 341 appendix Q5.2, AWS D1.1, AWS D1.8, ASTM E543, ASTM E1444, ASTM E164 and DSA IR 17-2.
- F. Steel Joists and Trusses: Continuous inspection, special inspector will verify size, type and grade for all chord and web members as well as connectors and weld filler material, verify joist profile, dimensions and chamber (if applicable); verify all weld locations, lengths and profiles; mark or tag each joist, in conformance with CBC section 2207.1 and DSA IR 22-3.
- G. Anchor Bolts, Anchor Rods and Other Steel:
- 1. Testing Laboratory will sample and test not readily identifiable anchor bolts and anchor rods in accordance with DSA IR 17-11.
 - 2. Testing Laboratory will sample and test not readily identifiable threaded rod not used for foundation anchorage per procedures noted in DSA IR 17-11.

PART 2 – PRODUCTS (Not used).

PART 3 – EXECUTION (Not used).

END OF SECTION

SECTION 01 7836

WARRANTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section includes administrative and procedural requirements for warranties, including manufacturers and installer's standard warranties on products and special product warranties.
 - 1. Refer to the General Conditions for terms of the guarantee period for the Work.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements.
- B. Section 01 7329 - Cutting and Patching.
- C. Section 01 7700 - Contract Closeout.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.01 WARRANTY REQUIREMENTS

- A. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties shall not relieve CONTRACTOR of the warranty of the Work incorporating such materials, products, and equipment. Manufacturer's disclaimers and limitations on warranties do not relieve suppliers, manufacturers, installers, and Subcontractors of the requirement to countersign special warranties with CONTRACTOR.
- B. Standard warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to OWNER.
- C. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for OWNER.

- D. Related Damages and Losses: When correcting failed or defective warranted Work, remove and replace Work that has been damaged as a result of such failure or which must be removed and replaced to provide access for correction of warranted Work.
- E. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement with the reinstated warranty equal to the original warranty.
- F. Replacement Cost: Upon determination the Work covered by a warranty has failed and/or is defective, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. CONTRACTOR is responsible for the cost of replacing or rebuilding defective Work regardless of whether OWNER has benefited from use of the Work through a portion of its anticipated useful service life.
- G. OWNER Recourse: Expressed warranties made to OWNER are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which OWNER can enforce such other duties, obligations, rights, or remedies.
- H. Rejection of Warranties: OAR reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
- I. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, OAR reserves the right to refuse to accept the Work until CONTRACTOR presents evidence the entities required to countersign such commitments have done so.

3.02 SUBMITTALS

- A. Submit written preliminary warranties prior to Substantial Completion and final warranties prior to Contract Completion. If the certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, submit written warranties as set forth in the certificate of Substantial Completion.
 - 1. When a designated portion of the Work is partially used and/or occupied by OWNER, submit properly executed warranties to ARCHITECT within fifteen days of the Partial Use or Occupancy of the designated portion of the Work.
- B. When the Contract Documents require CONTRACTOR, or CONTRACTOR and a Subcontractor, installer, supplier or manufacturer to execute a special warranty, prepare a written document containing appropriate terms and identification, ready

for execution by the required parties. Submit a draft to OAR, through the ARCHITECT, for approval prior to final execution.

1. Refer to Divisions 02 through 49 for specific content requirements and particular requirements for submitting special warranties.
- C. Form of Submittal: Prior to Contract Completion, compile two copies of each required final warranty properly executed by CONTRACTOR, or by CONTRACTOR and Subcontractor, installer, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the Specifications.
- D. Bind warranties and bonds in heavy-duty, commercial-quality, durable three ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8½ by 11 paper.
1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the item or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the installer.
 2. Identify each binder on the front and spine with the typed or printed title “WARRANTIES,” Project title and/or name, and name of CONTRACTOR.
 3. When warranted Work requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

END OF SECTION

SECTION 02 2600 - ABATEMENT OF HAZARDOUS MATERIALS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Abatement of hazardous materials identified in the Hazardous Materials Phase I Assessment Report, except for underground storage tanks, contaminated soil or groundwater. Furnish labor, materials, supplies, and incidentals required, protect Project site personnel and the surrounding public from exposure to potentially hazardous substances, and prevent the spread of potentially contaminated or hazardous substances.
2. The furnishing of labor, supervision, materials, equipment, tools, permits, manifesting, and services required in the characterization, transportation, and disposal of identified or suspected hazardous substances. The suspect substance may be in drums, containers, stockpiled, or may exist as debris piles on the Project site.

B. Related Requirements:

1. Section 00 3126 - Existing Hazardous Materials Information.
2. Division 01 - General Requirements.
3. Section 02 4119 – Selective Demolition
4. Section 02 8213 - Asbestos Abatement
5. Section 02 8333 - Lead Abatement and Lead Related Construction Work.

C. Regulatory Requirements shall include, but not be limited to: Comply with laws, ordinances, codes, rules, and regulations of the Federal, State and local authorities having jurisdiction over any of the Work specified herein. Comply with federal EPA and state Department of Transportation regulations for shipping of hazardous substances to offsite disposal facilities. Comply with any regulatory requirements imposed by the treatment, storage, and disposal facility. Regulations pertaining to the transport and disposal of hazardous substances/materials include, but are not limited to, the following:

1. Department of Transportation 49 CFR 172 through 179.
2. Department of Transportation 49 CFR 387 (46 FR 30974, 47073).
3. Department of Transportation DOT-E 8876.
4. Environmental Protection Agency 40 CFR 136 (41 FR 52779).
5. Environmental Protection Agency 40 CFR 261, 262 and 761.

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6. Resource Conservation and Recovery Act (RCRA).
- D. Any transporter of hazardous substances shall be licensed in the state in which handling and transportation will take place in accordance with applicable regulations.
- E. Comply with OSHA (Occupational Safety and Health Administration) Standards and Regulations contained in Title 29 Code of Federal Regulations, Part 1910.120 "Hazardous Waste Operations and Emergency Response."
- F. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.02 QUALITY ASSURANCE

- A. The Work of this Section shall be performed by an entity possessing the following minimum qualifications:
 1. Contractors License in the state where the Work is performed, supplemented by a Hazardous Waste specialty license, where applicable (i.e., California).
 2. MCS 90 Endorsement on Liability Insurance.
 3. Pollution Liability Insurance in the amount of \$2,000,000 occurrence.
 4. Forty-hour OSHA Training and site-specific health and safety plan for its employees proposed to work at the Project site as defined in 29 CFR 1910.120.
 5. A Comprehensive Quality Assurance Plan on file with the California Environmental Protection Agency.
 6. Project site personnel shall wear personal protective equipment and protective clothing consistent with the levels of protection required for this Work as specified by OSHA (29 CFR Part 1910.120).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 ABATEMENT OF HAZARDOUS MATERIALS

- A. Abate hazardous materials including hazardous materials identified in the Phase I Assessment Report.
- B. The Work of this section does not include the removal of underground storage tanks, contaminated soil or groundwater, unless specifically authorized in writing by the OAR.

3.02 CONTAINMENT OF RELEASED SUBSTANCES

- A. If a hazardous material appears to be leaking or otherwise spreading, contain the release of the material. Provide measures to prevent the release of the material to the environment and protect Project site personnel, adjacent properties and occupants, and the general public from potential exposure.

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- B. During the course of substance containment or evacuation of Project site personnel, protect personnel (onsite workers, non-workers, or the general public) from contact with or exposure to the released substances.
- C. The abatement or evaluation of any suspected hazardous material shall only be performed by properly trained and/or certified personnel.

3.03 HEALTH AND SAFETY

- A. In an emergency or imminent hazard situation the health and safety of personnel on or near the Project site are the responsibility of the Work of this section. Immediately notify the Owner office of Environmental Health and Safety (OEHS) and the OAR designated representative of the Owner Consultant. Owner representatives will notify Federal, State and Local regulatory authorities, if required.
- B. Project site personnel or members of the general public who have been exposed to or have come in contact with any hazardous materials or chemicals shall be immediately transported to the nearest hospital.

3.04 TESTING, TRANSPORT, AND DISPOSAL OF HAZARDOUS SUBSTANCES

- A. Collect one composite sample from each media type (solid, liquid, or sludge) of potentially hazardous substance stored in drums, stockpiled, or otherwise identified at the Project site for the purposes of obtaining approvals for proper transport and disposal of the suspect materials. Submit analytical results to a representative of the Owner Consultant, as designated by the OAR.
- B. If required, overpack any leaking or deteriorated drums to prevent leaks or spills, and pack small 5-gallon containers into larger new 55-gallon drums. Cover solid waste materials and stockpiled soils with an HDPE liner to prevent storm water runoff from contaminating surrounding areas.
- C. Prepare manifests, material profiles, and submit lab analysis for drums/containers and any other documentation required by the receiving facility for signature by a representative of the Owner Consultant and/or Owner, as designated by the OAR. Copies of waste profiles, manifests, and disposal documentation shall be submitted to the OAR designated representative of the Owner, prior to disposal and/or transporting of hazardous substances.
- D. Coordinate waste sampling and analysis requirements with the disposal facility and properly complete profiling and transport documents prior to loading and transport.
- E. A State registered "Hazardous Waste Hauler" shall transport the waste to a lawfully permitted and Owner approved facility.
- F. Prior to transport, a copy of the hazardous waste manifest shall be transmitted by facsimile, through the Project site Owner Consultant, to the Owner Office of Environmental Health and Safety (OEHS) for review and approval.
- G. Load, handle, and transport 55-gallon drums and other waste containers to the appropriate disposal facility in accordance with Federal and State regulations.
- H. Transport documentation from the receiving facility verifying acceptance and receipt of drums/containers at the facility and sampling and associated test results shall be submitted to

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the representative of the Owner Consultant, as designated by the OAR, within fifteen days following receipt of hazardous substances to the disposal facility.

- I. Materials identified as hazardous wastes under RCRA are not permitted to remain at the Project site more than 30 days after being deemed to be a hazardous waste. During this period of Project site storage, provide precautions to contain and prevent the release of hazardous or potentially hazardous materials to the environment.

END OF SECTION

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 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.

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: Detach items from existing construction and deliver them to Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 SUBMITTALS

- A. Qualification Data: For demolition firm.
- B. 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. Locations of proposed dust- and noise-control temporary partitions and means of egress.
 6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
 7. Means of protection for items to remain and items in path of waste removal from building.

- C. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.
- D. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
 - 1. Comply with submittal requirements in Division 1 Section "Construction Waste Management."

1.5 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.
- C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Standards: Comply with ANSI A10.6 and NFPA 241.
- E. Pre-demolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:
 - 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 PROJECT CONDITIONS

- A. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- B. Hazardous Materials: It is known hazardous materials will be encountered in the Work.
 - 1. Remove hazardous materials as part of this contract.
 - 2. See Appendix for following Reports:
 - a. Asbestos Building Inspection
 - b. Lead Building Inspection
 - c. Asbestos Sample Analysis
- C. Storage or sale of removed items or materials on-site is not permitted.

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- D. 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.

1.7 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. 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.
- E. Engage a professional engineer to survey 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 demolition operations.
- F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
 - 1. Comply with requirements for existing services/systems interruptions specified in Division 1 Section "Summary."
- B. Service/System Requirements: 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, before proceeding with selective demolition provide temporary services/systems that bypass

area of selective demolition and that maintain continuity of services/systems to other parts of building.

3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 - a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 PREPARATION

- A. 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.
 1. Comply with requirements for access and protection specified in Division 1 Section "Temporary Facilities and Controls."
- B. Temporary Facilities: 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 Division 1 Section "Temporary Facilities and Controls."
- C. 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.

3.4 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 adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly. Comply with requirements in Division 1 Section "Construction Waste Management."

B. 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.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
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.

- D. 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.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

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 Division 1 Section "Construction Waste Management."

B. Burning: Do not burn demolished materials.

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- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.6 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 024119

SECTION 02 8213 - ASBESTOS ABATEMENT AND ASBESTOS RELATED DISTURBANCE

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Abatement of building and/or structure related Asbestos.
2. Removal of building and/or structure related Asbestos.
3. Disturbance of building and/or structure related Asbestos.

B. Related Requirements:

1. Section 00 3126 - Existing Hazardous Material Information
2. Division 01 - General Requirements.
3. U.S. Environmental Protection Agency Regulations for Asbestos (Title 40, Code of Federal Regulations, Part 61, Subparts A and B, and Part 763, Subpart E.)
4. Title 8, Article 4, California Code of Regulations Construction Industry Safety Orders, Section 1529 "Asbestos" or current revised California regulations.
5. South Coast Air Quality Management District (SCAQMD) Rule 1403.

1.02 SECTION DEFINITIONS AND ACRONYMS

- A. Abatement – Procedures to control fiber release from Asbestos Containing Materials or Asbestos Containing Construction Materials. Includes Removal, Encapsulation, Enclosures, Repair, Demolition, and Renovation activities but does not include Asbestos Related Disturbance.
- B. AHERA - Asbestos Hazard Emergency Response Act, 40 CFR, Part 763, Subpart E, and subsequent amendments.
- C. Air Filtration and Ventilation System - A portable exhaust system, equipped with HEPA filtration, and capable of maintaining a constant air flow into a Regulated Area from adjacent areas and exhausted outside the Regulated Area.
- D. Amended Water - Water to which a surfactant (wetting agent) has been added.
- E. ANSI - American National Standards Institute.
- F. Asbestos - Means the asbestiform varieties of chrysotile (Serpentine); crocidolite (Riebecktite); amosite (cummingtonitegrunerite); anthophyllite; tremolite; and actinolite.
- G. Asbestos Containing Construction Material (ACCM) – Means any manufactured construction material which contains more than one tenth of one percent (0.1 percent) Asbestos by weight.
- H. Asbestos Containing Material (ACM) – Means any material containing more than one percent (1 percent) Asbestos.
- I. Asbestos Containing Waste (Non-hazardous) – Non-Friable Asbestos Containing Material including, but not limited to, floor covering, roofing materials and cementitious materials requiring disposal.
- J. Asbestos Containing Waste (Hazardous) – Friable Asbestos Containing Materials and Asbestos contaminated objects and debris requiring disposal.
- K. Asbestos Related Disturbance – is the drilling, coring, removal or similar disturbance of ACCM or ACM not to exceed three square feet in any one opening and not to disturb 100 square feet or greater cumulatively on any one project (contract).

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- L. ASTM - American Society for Testing and Materials.
- M. Building ID Number or Code - A six-digit alphanumeric identification code assigned to each building on an Owner site, also referred to as the insurance code, ID number or similar terms.
- N. Bulk Samples - Samples of building or other materials collected for analysis to determine the presence and quantities of Asbestos.
- O. Class I, II, III, and IV asbestos work has the meaning as defined in California Code of Regulations Title 8, Section 1529.
- P. Clean Room - An uncontaminated area or room, which is a part of the worker Decontamination Enclosure System with provisions for storage of worker's street clothes and clean protective equipment.
- Q. Competent Person - Has the same meaning as defined in the California Code of Regulations Title 8, as it relates to, "Competent Person."
- R. Controlled Disturbance – An activity by which a contractor disturbs an asbestos containing material or an asbestos containing construction material using the work practices allowed for in this specification and in compliance with regulatory limitations.
- S. Curtained Doorway – A device to allow ingress and egress from one room to another while permitting minimal air movement between the rooms, typically constructed by placing two overlapping sheets of plastic over an existing or temporarily framed doorway, securing each along the top of the doorway, securing the vertical edge of one sheet along one vertical side of the doorway and securing the vertical edge of the other sheet along the opposite vertical side of the doorway. Other effective designs may be submitted for review.
- T. Decontamination – The process of eliminating Asbestos contamination from building surfaces, objects, and property, by cloths, mops, or other utensils dampened with water and disposed of afterwards as Asbestos contaminated waste.
- U. Decontamination Enclosure System – Means an enclosed area, which is adjacent and connected to the Regulated Area, consisting of an Equipment Room, Shower Room, and Clean Room for the Decontamination of workers, materials, and equipment contaminated with Asbestos.
- V. Demolition - The wrecking or taking out of any load supporting structural member of a facility together with any related handling operations.
- W. DOSH - Division of Occupational Safety & Health or Cal/OSHA.
- X. DOT – Department of Transportation.
- Y. DTSC – Department of Toxic Substances Control.
- Z. Encapsulating Material - A liquid material applied to Asbestos Containing Materials which controls the possible release of Asbestos fibers from the material either by creating a membrane over the surface (bridging agent) or by penetrating into the material and binding its components together (penetrating Encapsulating Material).
- AA. Encapsulation - The application of an Encapsulating Material to Asbestos Containing Materials to prevent the release of Asbestos fibers into the air.
- BB. Enclosure - The construction or application of an airtight, impermeable, permanent barrier around Asbestos Containing Material to control the release of Asbestos fibers into the air.
- CC. Equipment Room - A room within the worker Decontamination Enclosure System with provisions for storage of used clothing and equipment and for controlled transfer of materials and equipment into and out of the regulated area.
- DD. Facility Component – Means any part of a facility including equipment.
- EE. FETU - Facilities Environmental Technical Unit.

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- FF. Fixed Object - A piece of equipment, furniture, or improvement in the Work area, which cannot be removed from the Work area.
- GG. Friable Asbestos - Asbestos Containing Material which, when dry, can be crumbled, pulverized or reduced to a powder by hand pressure or as defined by current regulations.
- HH. Glove Bag Technique - A method with limited applications for removing small amounts of Asbestos Containing Material from short piping runs, valves, joints, elbows, and other non-planar surfaces in a Work area. The glove bag assembly is a manufactured or fabricated device consisting of a glove bag (typically constructed of 6 mil transparent polyethylene or polyvinyl chloride plastic), two inward projecting long sleeves gloves, an internal tool pouch, and labeled for Asbestos waste. The glove bag is constructed and installed in such a manner that it surrounds the object or material to be removed and contains asbestos fibers released during the process. Workers who are permitted to perform the Glove Bag Technique shall be thoroughly trained, experienced, and skilled in this method.
- II. Hazardous Waste - Means Friable Asbestos generated and prepared for waste disposal. Does not include non-friable material or materials containing one-percent or less of Asbestos as determined by PLM and/or the point counting method.
- JJ. HEPA Filter - Means a filtering system capable of trapping and retaining at least 99.97 percent of mono-dispersed particles 0.3 microns in diameter or larger. For respirators this shall include NIOSH rated P-100 cartridges only.
- KK. HEPA Vacuum - A vacuum system furnished with HEPA filtration.
- LL. High Volume Vacuum - A vacuum system with the capacity to collect material through a four inch diameter hose a minimum distance of 150 feet. This system shall be furnished with HEPA Filter at the air exhaust port and water applicators within the hopper.
- MM. HVAC – Heating, Ventilation, and Air Conditioning System.
- NN. Location Code - Refers to a unique four digit numeric code assigned by the Owner to each of its Project sites.
- OO. Lockdown Coat – A material applied to surfaces where Asbestos has been completely removed. The manufacturer shall determine the concentration of this material.
- PP. Member – A component part of a structure complete in itself.
- QQ. Movable Object - A portable piece of equipment or furniture in the Work area, which can be removed from the Work area.
- RR. NESHAP - National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61).
- SS. NIOSH - National Institute for Occupational Safety and Health.
- TT. Outside Air - Air outside of buildings and structures.
- UU. Owner Consultant (OC) - Refers to the firm, company or individual designated by the Owner.
- VV. PCM - Phase Contrast Microscopy as it relates to clearance air, personnel exposure assessment, and ambient air monitoring. This procedure must follow the NIOSH Method 7400, Asbestos Fibers by PCM.
- WW. PLM - Polarized Light Microscopy used for bulk sample analysis with dispersion staining for the determination and quantifying of Asbestos in Bulk Samples building materials.
- XX. Regulated Area - Designated rooms, spaces or areas of the Project in which asbestos Abatement actions are to be performed or which may become contaminated as a result of Abatement activities. A contained Work area is a Work area, which has been sealed and furnished with a Decontamination Enclosure System. A non-contained Work area is an isolated or controlled access Work area, which has not been sealed or furnished with a Decontamination Enclosure System.
- YY. Removal – Means operations where ACM and/or PACM is removed or stripped from structures or substrates including Demolition.

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- ZZ. Renovation – Means the modifying of any existing structure, facility, or portion thereof.
- AAA. SCAQMD – South Coast Air Quality Management District.
- BBB. Shower Room - A room between the Clean Room and the Equipment Room in the worker Decontamination Enclosure System furnished with hot and cold running water controllable at the tap, and suitably arranged for complete showering during Decontamination.
- CCC. Small Scale Short Duration – Such work not to exceed amounts greater than those which can be contained in a single glove bag or may not exceed amounts which can be contained in a single prefabricated mini-enclosure. Such an enclosure shall conform spatially and geometrically to the localized work area, in order to perform its intended containment function, and as completely defined in 40CFR, 763, Subpart E, Appendix C.
- DDD. Staging Area - Areas near the Waste Transfer Airlock where containerized Asbestos waste is temporarily placed prior to permanent removal from the Work area.
- EEE. Surfactant - A chemical wetting agent added to water.
- FFF. TEM - Transmission Electron Microscopy as defined for Asbestos clearance air monitoring within AHERA. This procedure must follow the NIOSH Method 7402, Asbestos Fibers by TEM.
- GGG. TSI - Thermal System Insulation as defined in AHERA.
- HHH. USEPA or EPA – United States Environmental Protection Agency.
- III. Visible Emissions - Any emissions from a known or suspected Asbestos Containing Material that is visually discernible.
- JJJ. Waste Transfer Airlock - A Decontamination system provided for transferring containerized waste from inside to outside of the Work area.

1.03 POLICIES AND PROCEDURES

- A. The Owner has a zero-tolerance policy for uncontrolled Asbestos releases during construction or Abatement Work. An Asbestos release requiring an emergency response is any uncontrolled release of Asbestos Containing Construction Materials. The Owner shall be immediately notified of such uncontrolled releases.
- B. Pre-qualified Asbestos Abatement Subcontractors are not permitted to subcontract any Abatement work to a lower tier Subcontractor without the prior written approval of the Owner.
- C. Where ACM is damaged or disturbed, except during Controlled Disturbance or Abatement, Work in that room shall cease, the room be vacated immediately, the Owner Consultant notified of the disturbance with corrective action provided as required by the Owner Consultant.

1.04 ROLES AND RESPONSIBILITIES

- A. Roles and Functions:
 - 1. Coordinate the Work of this section directly with the Owner and/or Owner Consultant.
 - 2. Work under this section shall be performed in strict accordance with applicable Federal, State, and Local regulations, standards, and codes governing asbestos Abatement and any other Work performed in conjunction with the Asbestos Abatement Work.
 - 3. The most recent edition of any relevant regulation, standard, document, or code is in effect. Where conflict among the requirements or with this Specification exists, the most stringent requirement shall be provided.

1.05 SITE SECURITY

- A. The Work area shall be restricted to authorized, trained, and protected personnel. A list of authorized personnel shall be established by the Owner Consultant prior to commencement of the Work and posted at the entrance of the Regulated Area.

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- B. Report to the Owner Consultant any unauthorized entry into the Regulated Area. Following notification, a written report of the incident shall be provided to the Owner Consultant.
- C. A logbook shall be maintained at the entrance of the Regulated Area. Persons entering the Regulated area shall record their name, company affiliation, time in, and time out for each entry and exit.
- D. Access to the contained area shall be through the worker Decontamination Enclosure System or other room established when worker Decontamination Enclosure System is not required. Other means of access shall be blocked or locked to prevent entry to or exit from the Work area. The only exceptions are the waste pass-out airlock, which shall be sealed except during the Removal of containerized Asbestos waste from the Work area, and emergency exits in case of fire or accident. Emergency exits shall be operable from inside the Work area; however they shall be sealed with polyethylene sheeting and tape.
- E. Maintain Regulated Area security during Abatement Work. Regulated Areas and ancillary equipment accessible to non-authorized personnel shall be protected from unauthorized access by constructing a minimum barrier of 3/8 inch CDX plywood supported by 2 by 4 studs, 16 inches on center. Height shall be as required to safely access Regulated Area. An access door shall be provided with hasp and padlock sufficient to prevent unauthorized entry. A key shall be provided to the Owner and Owner Consultant. Required barriers within an occupied building shall be furnished with sheathing as required by state and local fire protection regulations.
- F. The protective barrier for a High Volume Vacuum shall be a minimum of eight feet in height. Barriers for these systems may be constructed of chain link type fencing instead of the specified barriers. Such fencing, if provided, shall be covered with an opaque covering resistant to environmental conditions. This barrier system shall be maintained at times while the enclosed equipment is on the Project site.
- G. Unless otherwise specified, remove barriers upon completion of the Work of this section. Repair and/or replace to original condition, damage resulting from installation, use, and removal of the barriers.

1.06

EMERGENCY PLANNING

- A. Emergency planning and procedures shall be developed, submitted, reviewed, and agreed to by the Owner prior to the commencement of Abatement Work.
- B. Emergency procedures shall be provided in the written languages understood by employees working on the Project and shall be prominently posted at the entrance of the Decontamination Enclosure System. Prior to entering the Work area, parties must read and sign these procedures to acknowledge receipt and understanding of the Work site layout, location of emergency exits, and emergency procedures.
- C. Emergency planning shall consider the effects of fire, explosion, toxic atmospheres, electrical hazards, slips, trips and falls, confined spaces, and heat related injury. Develop and provide written procedures and training to employees.
- D. Employees shall be trained in evacuation procedures in the event of workplace emergencies.
- E. In the event of non-life-threatening situations requiring medical treatment, injured or otherwise incapacitated employees shall decontaminate following normal procedures with assistance from fellow workers if necessary, before exiting the Work area.
- F. In the event of life-threatening injury or illness requiring immediate medical treatment, worker Decontamination shall be given minimum priority. Provide measures to stabilize the injured worker, remove them from the Work area and secure proper medical treatment.
- G. Telephone numbers of emergency response personnel shall be prominently posted at the entrance of the Decontamination Enclosure System along with the location of the nearest telephone. In addition to the 911 emergency number, post the address and telephone number of the nearest emergency medical services provider.
- H. Provide at least one employee on the Project site at times during progress of Abatement work that is trained and certified in first aid and cardiopulmonary resuscitation (CPR). This employee shall be

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identified by name and proof of training shall be provided to the Owner Consultant prior to the commencement of the Work of this section.

- I. Provide at least one 4A/60BC dry chemical extinguisher in the Equipment Room and one at each corner of contained areas in excess of 1,000 square feet. Workers shall be trained in the proper operation of fire extinguishers.
- J. Emergency exits shall be provided and clearly marked with arrows or other clearly visible markings to permit easy identification from anywhere within the Work area. Exits shall be secured to prevent access from uncontaminated areas while still permitting emergency egress. Exits shall be properly sealed with polyethylene sheeting, which can be cut to permit emergency egress. Emergency exits may lead through the worker Decontamination Enclosure, the waste removal airlock or other alternative exits as required by fire officials.

1.07 LICENSING

- A. The Work of this section shall be performed by an entity duly licensed in the State of California in accordance with the provisions of Chapter 9 of Division 3 of the Business and Professions Code, as amended. The Abatement work of this section shall be performed by an entity holding a license with an "ABS" Asbestos Certification as issued by the Contractors State License Board.
- B. The entity performing the Work of this section, other than Asbestos Related Disturbance involving less than 100 square feet shall be registered with the Department of Industrial Relations in accordance with the provisions of Section 6501.5 of the California Labor Code.

1.08 ASBESTOS RELATED REQUIREMENTS

A. Qualifications:

- 1. Comply with the provisions of the California Labor Code, Division 5, Part 1, as it pertains to safety in employment and the applicable provisions of Title 8, Chapter 4, Subchapters 1 through 21, California Code of Regulations (CCR) as it pertains to Occupational Safety and Health, and Subchapter 7, Section 5208 Article 4, and Section 1529, Asbestos regulations.
- 2. Where Electrical Work is required in a Regulated Area this work shall be performed as required in Division 16 and personnel who enter a Contained and Regulated Class I and II Asbestos work area are required to possess a current EPA certification as an Asbestos worker. Personnel who enter a Class III Asbestos Related Disturbance work area shall require personnel trained in accordance with AHERA Operations and Maintenance training requirements.

B. Abatement Activities:

- 1. The Asbestos Abatement work shall be performed by persons who comply with applicable Federal, State, and local regulations including AHERA certified training.
- 2. Supply labor, materials, services, insurance, permits, and equipment necessary to perform the Work in accordance with applicable Federal, State, and Local regulations and this Specification.
- 3. For Class I asbestos work, collect pre-Abatement air samples. Results shall be submitted prior to commencement of the Work of this section. Include location of Samples, name of air sampling professional, equipment, and methods utilized for sampling and analysis.
- 4. Submit weekly job progress reports detailing Abatement activities for Projects with schedules that exceed thirty days of Abatement work. Include review of progress with respect to previously established Milestones and schedules, major problems and action taken, injury reports, equipment breakdown, and air sampling results.
- 5. Within five workdays of transport and/or disposal, submit copies of transport manifests, disposal receipts, and weight certificates for Asbestos waste removed from the Work area

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during the Abatement process. Weight certificates shall indicate in pounds the net weight of waste disposed from the Project site as indicated on the manifest.

6. Submit copies on a daily basis of the Work site entry logbooks.
7. Submit logs on a weekly basis documenting filter changes on respirators, HEPA Vacuums, HEPA Filtered ventilation units, water filtration units, and other approved engineering controls.
8. Submit results of materials testing conducted during Asbestos Abatement work for purposes of utilization during such activities. (i.e., depth test, substitution materials, etcetera).
9. Where Decontamination Enclosure System is required, post at the entrance a list containing the names, addresses, and telephone numbers of the entity performing the Work of this section, designated Competent Person, the Owner and/or Owner Consultant, the testing laboratory and any other personnel who may be required to access the Work area or perform services during the Abatement Work.
10. For employee review, post at the entry of the Work area a copy of the scope of Work, special conditions, the current standard Specifications, and the applicable prevailing wage.

C. Asbestos Related Disturbance:

1. The Asbestos Related Disturbance Work shall be performed by persons who comply with applicable Federal, State, and local regulations including AHERA certified training.
2. Within ten days of analysis, submit results of air sampling data collected for Cal/OSHA compliance air monitoring during the course of the Asbestos Related Disturbance (Class III asbestos work). If this data is used to discontinue use of employee protective equipment then the data shall be provided before discontinuing use of protective equipment.
3. Within five workdays of transport and/or disposal of Asbestos Containing Waste, submit copies of transport manifests and/or disposal receipts.

1.09 SUBMITTALS

A. Provide in accordance with Division 01 and this section.

B. Prior to commencement of the Asbestos Abatement work of this section, submit the following notices, documentation, Shop Drawings, and Product Data:

1. For Projects involving Asbestos Containing Materials 100 square feet or more, provide a typed written notification in accordance with Rule 1403 of SCAQMD and 40 CFR Part 61.146 of Subpart M to the SCAQMD, and to and in accordance with the Division of Occupational Safety and Health prior to start of the Work.
2. Submit to the Owner, satisfactory proof the required permits, site location, and arrangements for transport and disposal of Asbestos Containing Waste materials have been completed in accordance with California Health and Safety Code, Section 25143.7. Obtain and submit a copy of handling procedures and a list of protective equipment utilized for Asbestos disposal at the landfill.
3. Submit to the Owner satisfactory documentation that employees, including foremen, supervisors, and any other company personnel or agents who may be exposed to airborne Asbestos fibers or who may be responsible for any aspects of Asbestos Abatement work or Asbestos Related Disturbance have received adequate training that includes, at a minimum, information as described within this section and as required by AHERA.
4. Prior to commencement of Abatement Work, personnel required to construct and enter the Work area or handle containerized Asbestos Containing Materials shall have received adequate training, in accordance with the requirements of this Specification and by 40 CFR, Part 763, Subpart E (AHERA) and Title 8, Section 1529, of the California Code of Regulations applies.

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5. Special Project site training for equipment and procedures unique to this Project site shall be provided as required.
6. Training in emergency response and evacuation procedures shall be provided to personnel performing Asbestos Abatement work of this section.
7. Submit documentation from a physician certifying that employees are medically monitored and are physically capable of working while wearing the required respiratory protection without suffering adverse health effects as required by California D.O.S.H regulations. Where such documentation is required, the certification shall state that the employee or agent is approved to work with Asbestos and wear a respiratory protection without restrictions. Provide information to the examining physician about unusual conditions in the workplace environment that may impact on the employee's ability to perform Abatement Work activities.
8. Submit Shop Drawings for layout and construction of Decontamination Enclosure Systems and barriers for isolation of the contained Asbestos Abatement work area as detailed in this Specification and required by applicable regulations.
9. When used, submit manufacturer's certification that HEPA Vacuums, air filtration units, and other local exhaust ventilation equipment complies with ANSI Z9.2.
10. Submit Product Data verifying that air filtration devices (i.e., air filtration units and vacuums) for use on this project have been registered or certified, as applicable, in compliance with the SCAQMD Rules.
11. If rental equipment is to be furnished in Abatement Work areas or to transport Asbestos contaminated waste, written notification concerning the intended use of the rental equipment shall be provided to the rental agency with a copy submitted to the Owner.
12. Document NIOSH approvals for respiratory protective devices furnished as required by the Work. Include manufacturer certification of HEPA filtration capabilities for cartridges and filters.
13. Submit documentation of respirator fit testing for employees and agents entering the Abatement work area or areas where respiratory protection is required. This fit testing shall be performed in accordance with DOSH regulations.
14. Submit a Sample of forms to be used in documenting required items to be submitted and/or reviewed.

C. Provide other required submittals specified as part of the Work of this section.

1.10

PRE-ABATEMENT MEETING

- A. Attend a meeting to be held prior to the commencement of Abatement Work. Attending this meeting shall be representatives of the Owner, the Owner Consultant if applicable, and the testing/monitoring personnel who shall actually participate in the testing/monitoring program. Secure the attendance of the individual who will be the Project site Competent Person for the Abatement Work.
- B. Included in the general preconstruction meeting will be a discussion of requirements and submittals for Asbestos Related Disturbance, where such applies.
- C. At this meeting provide required submittals except for those to be submitted during progress of the Work. In addition, provide detailed information concerning:
 1. Preparation of Work area and Shop Drawings. (Abatement Only).
 2. Personal protective equipment, including respiratory protection and protective clothing. (Abatement, and Asbestos Related Disturbance if required).
 3. Employees who will participate in the Project, including delineation of experience, training, and assigned responsibilities during the Work. (Abatement and Asbestos Related Disturbance).

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4. Decontamination procedures for personnel, Work area, and equipment. (Abatement and Asbestos Related Disturbance).
5. Abatement methods and procedures to be provided. (Abatement Only).
6. Required air monitoring procedures (pre-Abatement and SCAQMD requirement [**Abatement Only**], and Cal/OSHA mandatory [**Abatement and Asbestos Related Disturbance**]).
7. Procedures for handling and disposing of waste materials, including disposal facility. (Abatement and Asbestos Related Disturbance).
8. Procedures for final Decontamination and cleanup. (Abatement Only).
9. A sequence of Work activities and performance schedule. (Abatement Only).
10. Procedures for dealing with heat stress. (Abatement Only).
11. Emergency procedures. (Abatement Only).

1.11

CLOSE OUT DOCUMENTATION

A. Provide the following close out documentation:

1. Filter change logs for air filtration units, water filtration units and respirators. (Abatement Only).
2. Foreman's daily job reports. (Abatement Only).
3. Employee entry/exit logs for containment. (Abatement Only).
4. Visitor entry/exit logs for containment. (Abatement Only).
5. Manometer printout reports for applicable containment. (Abatement Only).
6. Air sample results for personnel (Abatement and Asbestos Related Disturbance).
7. Air Samples for Abatement Work areas and air filtration units. (Abatement Only).
8. Copies of hazardous and non-Hazardous Waste manifests. (Abatement and Asbestos Related Disturbance).
9. Hazardous Waste weight tickets. (Abatement Only).
10. Signed Daily Personnel Report Forms. (Abatement Only).
11. Signed code of conduct form from each employee working on a Project. (Abatement Only).
12. Signed asbestos Abatement Project Personnel Logs. (Abatement Only).

B. Receipt of the last workday attendance log and the daily personal monitoring results shall be submitted within two days upon completion of the Abatement Work of this section.

PART 2 – PRODUCTS

2.01

Materials and Equipment:

A. Materials

1. Products: The following products have been specifically approved for use as encapsulants/lock-down or bridging agents for Owner asbestos abatement and asbestos related construction projects and lead abatement and lead related construction projects. Products not approved by the Owner shall not be used.
 - a. Asbestos Removal Encapsulant: Foster 32-60 blue by Foster Products Corporation; removal, lock down or penetrating with dilution.
 - b. Asbestos Bridging Encapsulant: Foster 32-80 by Foster Products Corporation; for pipe covering and boiler lagging.
 - c. A-B-C Fiberspray 6410 and 6422SP by Fiberlock Technologies, Inc.; for coring, small jobs and gloves bags.

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- d. A-B-C Asbestos Binding Compound 6421, 6422 and 6423 by Fiberlock Technologies, Inc.; for general use, removal, lock down, penetrating and bridging; good for soils.
 - e. Fiberset PM 7475 clear by Fiberlock Technologies, Inc.; compatible with flooring.
 - f. Fiberset PM 7470 white by Fiberlock Technologies, Inc.; compatible with flooring.
 - g. Lag-Kote by Fiberlock Technologies, Inc.; multi-use product including fireproofing and thermal system insulation.
 - h. Lag-Klothe by Fiberlock Technologies, Inc.; water activated repair cloth for pipes, boilers and breaching.
2. General:
- a. Deliver materials in the original sealed packages, containers, or bundles bearing the name of the manufacturer and brand name.
 - b. Store materials subject to damage off the ground, away from wet or damp surfaces, and under cover sufficient enough to prevent damage or contamination. Replacement materials shall be stored outside of the Abatement Work area until area is cleared for normal occupancy.
 - c. Damaged, deteriorating or previously used materials shall not be furnished and shall be removed from the Project site and legally disposed of.
 - d. A sufficient supply of disposable mops, rags, and sponges for Abatement Work area Decontamination shall be provided.
 - e. Unless otherwise specified, the Owner will provide water and power for construction purposes. Connect to existing system as required.
3. Asbestos Related:
- a. Plastic, polyethylene sheeting or visqueen shall be a fire retardant type. Provide documentation from the manufacturer verifying compliance with this requirement.
 - b. Where a contained work area is required for Abatement Work, a minimum of two layers of 4-mil polyethylene sheeting shall be installed for walls. For floors and other installations, polyethylene sheeting of at least 6-mil thickness shall be furnished in sufficient widths to minimize the frequency of joints.
 - c. Method of attaching polyethylene sheeting shall be reviewed prior to installation and/or commencement of Abatement Work. Method of attaching polyethylene sheeting shall not cause damage to equipment, finish surfaces, or other property.
 - d. Polyethylene sheeting furnished for the Decontamination Enclosure System shall be opaque white or black in color and shall be a minimum of 6-mil thick.
 - e. Disposal bags shall be of 6-mil polyethylene, with the outer bag pre-printed with labels as required by SCAQMD and applicable Cal/OSHA and DOT requirements at a minimum.
 - f. Apply labels as per SCAQMD, Cal/OSHA, and DOT requirements for disposal containers.
 - g. Provide warning signs as required by CAL/OSHA.
 - h. Surfactant (wetting agent) shall be a material that, when tested, demonstrates a surface tension of 29 dynes/cm as tested in its properly mixed concentration, using ASTM method D1331 - Surface and Interfacial Tension of Solutions of Surface Active Agents. Where Work area temperature may cause freezing of the Amended Water solution, the addition of approved antifreeze in a manufacturer recommended amount is permitted.

B. Equipment

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1. General:
 - a. Equipment delivered to the Project site shall be free of Asbestos and/or fibrous debris. No equipment with Asbestos and/or fibrous debris in or on it is permitted on Owner properties.
 - b. Provide sufficient lighting to illuminate the Work area for safe visual working conditions and to clearly examine surfaces.
 - c. Provide a sufficient supply of scaffolds, ladders, lifts, and hand tools that meet applicable Federal, State, and local regulations.
 - d. Provide non-metallic dustpans, squeegees, and shovels for cleanup.
2. Asbestos Related:
 - a. A sufficient quantity of air filtration ventilation units furnished with HEPA filtration and operated in accordance with ANSI Z9.2-79 and EPA guidance documents shall be furnished to provide one workplace air change every 15 minutes creating -0.02 column inches of water pressure differential everywhere within the contained area when compared to the pressure outside the area. For small Enclosures and glove bags, a HEPA Filtered vacuum system may be furnished to provide the pressure differential. A log documenting the filter change history of each unit is required before use. Any unit without this log shall have filters changed and the unit decontaminated.
 - b. Provide a printable manometer for determining and recording the pressure differential within the isolated Work area as compared with the ambient environment. A printed record is required for the duration of the Project. The manometer shall operate 24 hours per day with a printed differential reading not to exceed fifteen minute intervals.
 - c. High volume vacuum equipment shall be provided during soil Removal operations unless otherwise specified.
 - d. Provide sprayers with pumps in a quantity capable of providing Amended Water in sufficient quantities to adequately wet materials during Asbestos Abatement activities. Provide spray bottles or adequate equipment necessary to keep materials impacted by Asbestos Related Disturbance adequately wet.
 - e. Non-skid footwear shall be worn by Abatement workers. Disposable clothing shall be adequately sealed to the footwear to prevent body contamination.
 - f. Provide other required safety equipment to workers and authorized visitors.
 - g. When roll-off disposal containers are delivered to a Project site, four wheels of each container shall be moved and rested upon a sheet of plywood no smaller than four-foot by four-foot by ¾ inch minimum.

2.02 EMPLOYEE PERSONAL PROTECTIVE EQUIPMENT

A. Respiratory Protection:

1. Where respirators are required these shall be provided for protection from particulate contaminants as required by the National Institute of Occupational Safety and Health.
2. The respirators provided shall furnish a protection factor as required by CCR Title 8, Section 1529 for the fiber concentration in the work area. When powered air purifying respirators are provided, a sufficient supply of charged replacement batteries, filters, and a flow test meter shall be provided in the Clean Room area. Air purifying respirators with dual HEPA Filters may be provided during Work area preparation activities.
3. Provide spectacle kits and eyeglasses for employees who wear glasses and must wear full-face respirators.

B. Fit Testing:

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1. Workers must perform positive and negative air pressure fit tests each time a respirator is donned, whenever the respirator design so permits. Powered air purifying respirators shall be tested for adequate flow as specified by the manufacturer.
2. Workers shall be undergo a qualitative fit test in accordance with procedures detailed in the D.O.S.H. requirements for respirators provided to comply with the requirements of this Project. An appropriately administered quantitative fit test may be substituted for the qualitative fit test.
3. Where respirators are required, documentation of adequate respirator fit must be provided to the Owner Consultant.
4. No one wearing a beard shall be permitted to don a respirator and enter the Work area.
5. Where respirators are required, a minimum of two additional respirators of each type and training on their donning and use must be provided at the Work site for authorized visitors required to enter the Work area.

C. Protective Clothing:

1. Where protective clothing is required, full body disposable protective clothing, including head, body, and foot coverings, shall be provided to workers and authorized visitors in sizes adequate to accommodate movement without tearing.
2. Disposable clothing including head, foot, and full body protection shall be provided in sufficient quantities and adequate sizes for workers and authorized visitors.
3. A new suit shall be donned upon each entry to the Abatement Work area or area where the permissible exposure level will be exceeded.
4. Hard hats, protective eye wear, gloves, rubber boots and/or other footwear shall be provided as required for workers and authorized visitors. Safety shoes may be required and shall be provided.

PART 3 - EXECUTION

3.01 ABATEMENT PROCEDURES AND WORK AREA PREPARATION

A. Work Area Preparation

1. For Class I and II asbestos work, shut down and lock out heating, cooling and air conditioning system (HVAC) components that are located in, supply, or pass through the Work area. Seal intakes and exhaust vents in the Work area with tape and 6-mil polyethylene. Seal seams in any system components that pass through the Work area.
2. Provide and post signs at locations and approaches to the Regulated Area. The signs shall comply with Cal/OSHA regulations.
3. In conjunction with the Owner, shut down and lock out/tag out electric power to Class I and II asbestos work areas. Provide equipment for temporary power with ground fault interrupters and lighting sources. Temporary power sources and equipment shall comply with applicable electrical code requirements and Cal/OSHA requirements for temporary electrical systems. The Owner shall perform electrical connections of electrical cable and equipment provided as part of the Work of this section to existing Owner systems. The Owner shall pay for the costs of electric power consumed during performance of the Work of this section, unless otherwise noted.
4. For Class I and II asbestos work, clean and seal off windows, doorways, elevator openings, corridor entrances, drains, ducts, grills, grates, diffusers, skylights, and any other openings between the Abatement Work area and areas outside of the Abatement Work area with 6-mil polyethylene sheeting and tape prior to proceeding with required cleaning.
5. Clean Movable Objects within the Abatement Work area with a HEPA Filtered vacuum and wet cleaning methods. After cleaning, these objects shall be removed from the Abatement work area and carefully stored in a location designated by the Owner.

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6. Clean Fixed Objects in the Abatement Work area with a HEPA Filtered vacuums and wet cleaning methods. Careful attention shall be given to machinery behind grills or gratings where access may be difficult but contamination is present. Cleaning of walls, floors, and ceilings behind fixed items is required. After cleaning, enclose Fixed Objects in 6-mil polyethylene sheeting and seal securely in place with durable tape.
7. Clean surfaces in the Abatement Work area with a HEPA Filtered vacuums and wet cleaning methods. Do not utilize any methods, such as dry sweeping or vacuuming, with equipment not furnished with HEPA Filters thereby creating airborne dust and particulates. Do not disturb Asbestos Containing Materials during this cleaning phase.
8. For Class I and II asbestos work, floors shall be covered with two layers of 6-mil (minimum) polyethylene sheeting. Additional layers of sheeting may be furnished as drop cloths for cleanup of bulk materials.
9. Polyethylene sheeting shall be sized and installed to minimize seams. If the floor area to be covered requires seaming, seams on successive layers of polyethylene sheeting shall be staggered a minimum of six feet between each seam to reduce the potential for water penetration into the existing flooring. Do not install seams at the junction between a wall and floor.
10. Polyethylene sheeting installed on a floor shall extend at least 12 inches up the sidewalls of the Abatement Work area.
11. Polyethylene sheeting shall be installed so as to prevent slippage between successive layers of installed material.
12. For Class I and II asbestos work, walls shall be covered with two layers of 4-mil minimum thickness polyethylene sheeting.
13. Polyethylene sheeting installed on a wall shall overlap floor sheeting by at least 12 inches beyond the wall/floor joint to provide a seal against water damage.
14. Polyethylene sheeting installed on a wall shall be adequately fastened to prevent it from falling away from the walls. Provide additional support/attachment when air filtration ventilation systems are provided.
15. For Class I and II asbestos work with porous, dropped, or perforated ceilings, those ceilings shall be covered with one layer 4-mil minimum thickness polyethylene sheeting.
16. Polyethylene sheeting installed on ceilings shall be adequately fastened to prevent it from falling away from the ceiling.
17. Provide one layer of 3-mil maximum, polyethylene sheeting (non-fire retardant type) for isolation of fire sprinkler devices. Installed taping shall not impede the normal function of the fire sprinkler device. Approved wire sprinkler guards shall be furnished in conjunction with isolation.
18. Where required, install and operate air filtration equipment to provide one air change in the Abatement Work area every 15 minutes. Openings made in the Enclosure System to accommodate these units shall be made airtight with durable tape and/or caulking as needed. If more than one unit is installed, they shall be turned on one at a time, checking the integrity of barriers after each unit is started. Insure that adequate power supply is available to satisfy the requirements of the air filtration units. Exhaust from these units shall be directed to the outside of the building whenever feasible. They shall not be exhausted into occupied areas of the buildings. Exhaust duct shall be extended from the Abatement Work area to the outside as required. Careful installation and daily inspections shall be performed to verify the exhaust ducts do not discharge into any areas of the building.
19. Once the Enclosure system is constructed and reinforced with air filtration units in operation as required, test the Enclosure for leakage utilizing smoke tubes. Repair, replace or reconstruct as required.

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20. Following completion of the construction of polyethylene barriers and Decontamination Enclosure System, operate the air filtration units overnight to insure the barriers will remain intact and secured to walls and fixtures before beginning actual Abatement Work.
21. Commencement of the Work of this section shall not occur until:
 - a. The entire containment system has been constructed and inspected by Owner Consultant in accordance with the required Shop Drawings.
 - b. Air filtration units are functioning within the requirements of this section.
 - c. Air filtration units are functioning within the requirements of this section.
 - d. Pre-Abatement submittals, notifications, postings, and permits have been provided and reviewed by the Owner Consultant.
 - e. Equipment for Abatement, Decontamination, and disposal are on the Project site.
 - f. Worker training, respirator fit testing, and medical surveillance has been provided and reviewed by the Owner Consultant.
 - g. A Notice to Proceed is transmitted by the Owner.

3.02 ASBESTOS RELATED DISTURBANCE WORK PRACTICES (Small-Scale, Short Duration – SSSD)

- A. For Class III work, shut off air handling equipment to rooms work will occur in.
- B. Provide and post signs at the entrance to the work area affected. The signs shall comply with Cal/OSHA regulations.
- C. For Class III work clean the area immediately under the location to be disturbed.
- D. For Class III work move any moveable furniture or objects from immediately beneath the area to be disturbed.
- E. Provide an enclosure around the area of disturbance. This may include, but is not limited to:
 1. Mini-enclosure where not more than two persons may occupy for the purpose cutting holes up to three square feet in walls or ceilings.
 2. For drilling, coring, sawing or similar disturbance, an enclosure shall be placed over the area of disturbance of sufficient size to cover that area and contain the tools used. This can include drilling with a shroud, through a wet sponge, through a plastic enclosure, or similar designs which will ensure control of Asbestos fibers and other dust. Drilling or coring with the use of a vacuum collection device shall be equipped with a HEPA filtered vacuum.
- F. Class III work performed without a HEPA vacuum collection device shall have surfaces of disturbance adequately wet to control fiber release.
- G. Clean by wet method the surfaces disturbed, the enclosure device and/or materials used, and any tools used during the disturbance operation.
- H. Clean up by wet method and/or HEPA vacuum any debris that may have escaped outside the enclosure required by this section.

3.03 DECONTAMINATION ENCLOSURE SYSTEM FOR ABATEMENT WORK

- A. Decontamination Enclosure Systems shall be provided at locations where workers will enter or exit the Abatement Work area of Class I and II asbestos work prior to any other set up. Only one system at a single location for each Regulated Area is required. At least one individual shall be stationed at the entrance of each system at times Abatement Work is in progress.
- B. These systems may consist of existing rooms outside of the Abatement Work area, if the layout permits, and that can be enclosed in polyethylene sheeting, and are accessible from the Abatement Work area. If

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this intended layout is not feasible, given existing site conditions, Enclosure systems may be constructed out of metal, wood, or plastic support as required.

- C. Decontamination Enclosure Systems constructed at the Project site shall be furnished with 6-mil opaque white or black polyethylene sheeting or other approved materials for privacy. Detailed descriptions of portable, prefabricated units, if furnished, shall be submitted for review. Shop Drawings must include floor plan with dimensions, materials, size, thickness, plumbing, and electrical utilities.
- D. Decontamination Enclosure System shall consist of at least a Clean Room, a Shower Room, and an equipment room, each separated from the other, from the Abatement Work area and from the non-Work area by "Z-flaps" at a minimum. The system shall be furnished with, at a minimum, two layers of 6-mil polyethylene sheeting on the floors, walls, and ceiling.
- E. Clean room shall be of adequate size to accommodate the Abatement crew. Clean work clothes, clean disposable clothing, replacement filters for respirators, disposable towels, and other necessary items shall be provided for in adequate supply adjacent to the Clean Room. A location for posting notices shall also be provided adjacent to this area. When required, a lockable door shall be furnished to control access into the Clean Room from outside the Abatement Work area. Comfort lighting, heat, and electricity shall be provided as required. The Clean Room shall not be used for storage of tools, equipment, materials, or as office space.
- F. Shower room shall contain one or more showers as required to adequately accommodate workers. Each showerhead shall be supplied with hot and cold water adjustable at the tap. The shower Enclosure shall be constructed to ensure against any kind of leakage. Provide an adequate supply of soap, shampoo, and disposable towels, available at times. Shower water shall be drained, collected, and progressively filtered through a system achieving a maximum particle size of 1.0 microns.
- G. The Equipment Room shall be used for storage of equipment and tools at the end of a shift. These shall have been cleaned using a HEPA Filtered vacuum and wet cleaning methods. A container lined with a labeled 6-mil polyethylene bag for collection of disposable clothing shall be located in this room. Reusable footwear shall be stored in this area after being cleaned.

3.04 WASTE CONTAINER REMOVAL AIRLOCK AND EMERGENCY EXITS

- A. The waste container pass-out airlock shall be constructed away from the Decontamination Enclosure System. This airlock shall be in a location that provides direct access from Abatement Work area to the outside of the building if possible.
- B. This system shall consist of an airlock, container Staging Area, and another airlock providing access to outside Abatement Work area.
- C. The waste container airlock shall be constructed in similar fashion with similar materials as the Decontamination Enclosure System.
- D. This airlock system shall not be used to enter or exit the Abatement Work area.

3.05 ALTERNATIVE PROCEDURES

- A. Soil Removal
 1. Required Asbestos Abatement shall be performed prior to soil Removal.
 2. If soil Removal is specified, debris within or upon the soil shall be considered part of the soil and shall be removed as a contaminated waste. Debris includes, but is not limited to, fabric, paper, and other fibrous or porous materials.
 3. It is not the intention of this section to require the Removal of large rocks, abandoned non-Asbestos-containing pipe, lumber, and similar debris. If these conditions are encountered, clean and encapsulate these materials instead of removing them as a contaminated waste, provided Asbestos contamination is not ingrained within and/or affixed to them. Any such materials remaining shall be stacked to one side to allow for access to the soil below for removal purposes.

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4. Unless otherwise specified, soil shall be removed with a High Volume Vacuum system. Soil shall be removed to the hard pan unless otherwise specified or required.
5. After soil Removal has been completed, the Owner Consultant shall inspect the Work. Approval of the Removal Work is required prior to lock down and Encapsulation.
6. Soil requires Encapsulation following Asbestos Removal, including but not limited to, High Volume Vacuum removal. Apply a continuous even coat of encapsulating material at the rate of no more than fifty square feet per gallon. Other structural surfaces shall receive an evenly applied coat of lock down material.

B. Other:

1. High Volume Vacuum systems shall be provided with an Enclosure constructed at the waste discharge port. This Enclosure shall be of sufficient size to accommodate the workers and disposal containers necessary for the Project. The Enclosure shall be constructed of one layer, 6-mil minimum, of polyethylene sheeting. An air filtration unit shall be furnished during operation of the High Volume Vacuum.
2. Where pipe insulation is to be removed in a crawl space and/or attic space a single layer of 6-mil polyethylene sheeting with a minimum width of four feet shall be placed centered under the Removal surfaces.
3. If specified procedures cannot be furnished, a written request shall be provided to the Owner outlining details of the problem encountered and recommended alternative solutions.
4. Alternative procedures shall provide equivalent or greater protection than the specified and/or required procedures.
5. Any alternative procedure requires the written approval of the Owner prior to implementation.

3.06

WORKPLACE ENTRY AND EXIT PROCEDURES

- A. Before entering the Regulated Area personnel shall read and be familiar with posted regulations, personal protection requirements, and emergency procedures. A signature sheet shall be posted for signatory acknowledgement these have been reviewed and understood by personnel prior to entry.
- B. Workers and other authorized personnel shall enter the Abatement Work area through the Decontamination Enclosure System or other room required when Decontamination Enclosure System is not required.
- C. Personnel who enter or exit the Regulated Area shall sign the entry and exit log located adjacent to the Clean Room.
- D. Personnel shall proceed first to the Clean Room, don respirator, and washable and/or disposable clothing.
- E. General construction area equipment including, but not limited to, hard hats, eye protection, and gloves shall also be provided as required. Clean respirator and cartridges, and protective clothing shall be provided and utilized by each person for each separate entry into the Regulated Area.
- F. Before leaving the Regulated Area for Class I and II asbestos work personnel shall remove gross contamination from the outside of respirators and protective clothing by vacuuming and/or wet wiping methods. Each person shall clean protective footwear just prior to entering the Equipment Room.
 1. Personnel shall proceed to Equipment Room where they remove protective equipment except respirators. Deposit disposable clothing into appropriately labeled containers.
 2. Still wearing respirator, personnel shall proceed to the shower area, clean the outside of the respirators and the exposed face area under running water prior to removal of respirator then shower and shampoo to remove residual Asbestos contamination. Various types of respirators will require slight modification of these procedures. A powered air purifying respirator face piece will have to be disconnected from the filter/power pack assembly when such is not

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waterproof, upon entering the shower. A dual cartridge respirator may be worn into the shower and cartridges shall be replaced for each new entry into the Work area.

3. After showering and drying off, proceed to the Clean Room and don clean clothing.

G. At no time shall any personnel exit an Abatement Work area into a space occupied by staff or students without being completely dressed. Any violation of this requirement will result in the permanent removal of the person from the Project site.

3.07

REMOVAL PROCEDURES

A. Brushes furnished for removing loose Asbestos Containing Material during detail cleaning of substrate shall be furnished with nylon or fiber bristles. Metal or wire brushes are not permitted. Brushes used during this process shall be disposed as contaminated waste when use of the brush for this work is completed.

B. A sufficient supply of HEPA Filtered vacuum systems shall be provided during cleanup of Abatement Work. Brush attachments are not permitted for use with vacuum systems.

C. Barriers constructed to isolate the Regulated Area from other areas shall be inspected at least three times per shift; prior to the start of Abatement activities; half way into the shift; and following the completion of the Abatement activities at the end of the shift. Inspect and document observations in the daily Project log.

D. Damage and defects in the Enclosure system shall be repaired immediately upon discovery.

E. At any time during Abatement Work, following barrier installation, if visible debris is observed outside of the Regulated Area or damage occurs to the barriers, stop Work immediately. Repairs shall be performed to the barriers and debris/residue shall be cleaned up with appropriate HEPA Vacuuming and wet wiping methods. These incidents shall be recorded in the daily Project log.

F. If air samples collected outside of the Work area during Abatement Work indicate airborne fiber concentrations greater than 0.01 f/cc or the pre-measured background levels (whichever is lower) Work shall stop immediately. An inspection and repair of barriers shall be performed as required. Surface cleaning with HEPA Vacuums and wet wiping methods of areas outside of the Work area may be required by the Owner. Findings, observations, and corrective actions shall be documented in the daily Project log.

3.08

ENCAPSULATION AND BRIDGING AGENTS

A. Clean and isolate the Work area in accordance with "Work Area Preparation" of this Section.

B. Repair damaged and missing areas of existing materials with non-Asbestos containing substitutes. Material shall adhere adequately to existing surfaces and provide an adequate base for application of Encapsulating Material. Filler material shall be installed in accordance with manufacturers recommended specifications.

C. Remove loose or hanging Asbestos Containing Materials in accordance with the requirements of "Removal Procedures" in this Section.

D. Lockdown and Encapsulating Material, and bridging agents shall be reviewed by the Owner Consultant prior to the commencement of the Work of this section.

E. Encapsulating Material shall be sprayed applied with airless spray equipment. Nozzle pressure shall be adjustable within a range of 400 to 1500 PSI.

F. Lock down coat shall be spray applied with low pressure providing a continuous even coat.

G. Bridging agents shall be a palm or brush grade.

H. Colorless lock down materials, Encapsulating Material, and bridging agents shall be furnished with a compatible color additive. A different color shall be furnished for each separate coat of applied material.

I. Install penetrating type Encapsulating Material to penetrate existing sprayed applied Asbestos Containing Materials to a depth as required.

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- J. During installation of the penetrating type Encapsulating Material; remove selected random core samples of the Asbestos Containing Materials in the presence of the Owner Consultant to verify depth of penetration.
- K. Lock down coating and Encapsulating Material for installation on hot water, steam, or any other high temperature equipment shall be manufactured and recommended for installation on high temperature systems.

3.09 CLEAN UP PROCEDURES

A. Asbestos Clean Up Procedures:

1. Unless decontaminated daily, reusable footwear and kneepads shall be stored in the Equipment Room when not in the Work area. Upon completion of Abatement Work, these shall be disposed of as Asbestos contaminated waste or may be decontaminated at the completion of Abatement Work.
2. Remove and containerize visible accumulations of Asbestos Containing Material and Asbestos contaminated debris with rubber dustpans and rubber squeegees. Do not use metal shovels to pick up or move accumulated waste. Special care shall be taken to minimize damage to flooring materials.
3. Remove containerized waste from the Abatement Work area and the waste container airlock.
4. Wet wipe surfaces in the Regulated Area with clean rags, mops, and sponges as appropriate.
5. After cleaning remove the top layer of polyethylene sheeting from walls and floors.
6. Clean the second layer of polyethylene sheeting by wet wipe and HEPA Vacuuming. Windows, doors, HVAC system vents, and other critical seals shall remain sealed until the Abatement Work area passes final clearance. The air filtration units shall remain in continuous operation and the Decontamination Enclosure System shall remain in place and be utilized.
7. Decontaminate tools and equipment and remove at the appropriate time in the cleaning process.
8. Provide notification to the Owner at least one day in advance when Abatement Work will be completed and ready for final visual inspection. If, upon inspection, Abatement Work is not completed or the area does not pass final visual inspection, finish or correct the Abatement Work as required before notifying the Owner. Subsequent inspections shall commence not later than one day following notice.
9. The Owner Consultant shall inspect the Work area for visible residue. If residue is observed, it shall be deemed to contain Asbestos and the cleaning process shall be repeated. The lock down coat shall be applied only after inspection by the Owner Consultant and during non-school hours.
10. The second layer of isolation shall only be removed after the Owner Consultant inspects the lock down coat or installed Encapsulation, but in no case prior to overnight drying of lock down coat or Encapsulation.
11. Following completion of air clearance monitoring the remaining barriers shall be removed and properly disposed of. A final visual inspection by the Owner Consultant shall be performed to verify that no contamination remains in the Abatement Work area. Unsatisfactory conditions may require additional cleaning and air monitoring.

3.10 WASTE HANDLING AND TRANSPORTATION

A. Asbestos Waste Handling

1. As the Work progresses, to prevent exceeding available storage capacity on the Project site, sealed and labeled containers of Asbestos Containing Waste shall be removed and transported to the prearranged disposal location.
2. Waste disposal shall occur at an authorized site in accordance with regulatory requirements of NESHP and applicable State and Local regulations.

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3. Once the drums, bags, and/or wrapped components have been removed from the Work area, they shall be loaded into an enclosed truck for transportation.
4. Waste shall not be transported from the work area to the storage container or waste hauler's vehicle while students or staff are present in the path of travel. Where a path of travel cannot be cordoned off the movement of waste must be completed prior to or after the presence on site of students and staff.
5. Personnel loading Asbestos waste shall be protected with disposable clothing and at a minimum half-face, air purifying, dual cartridge respirators furnished with HEPA Filters.

3.11 TRANSPORTATION OF NON HAZARDOUS WASTE

- A. Waste shall be containerized, labeled, and transported in accordance with federal, state, and local regulations.
- B. Waste shall be transported under cover a non-Hazardous Waste manifest.
- C. Containers shall be enclosed during transportation.

3.12 TRANSPORTATION OF HAZARDOUS WASTE

- A. Dump receipts; trip tickets, transportation manifests, weight certificates or other documentation of disposal shall be delivered to the Owner Consultant within 48 hours of disposal. As the material and responsibility for the material changes hands, the generator or designee, the transporter(s), and the Disposal Site Operator shall sign the Uniform Hazardous Waste Manifest. If a separate waste hauler is employed, the name, address, U.S.E.P.A. ID number, and signature of the transporter shall also be affixed onto the manifest.
- B. The enclosed cargo area of trucks or containers shall be free of debris and lined with 6 mil polyethylene sheeting to prevent contamination from leaking or spilled containers. Floor sheeting shall be installed first and extend up the sidewalls. Wall sheeting shall be overlapped and taped into place.
- C. Drums shall be placed on level surfaces in the cargo area and packed tightly together to prevent shifting and tipping. Large structural components shall be secured to prevent shifting, with bags placed on top.
- D. Access openings on large metal containers, which are used for storing or transporting Asbestos waste, shall have doors and tops that can be closed and locked. Materials not properly bagged shall not be placed in these containers nor shall these containers be used for non-Asbestos waste or nonhazardous asbestos waste. Bags shall be placed, not thrown, into these containers to avoid damage.

3.13 MONITORING

- A. Abatement Project Management and Inspection:
 1. Owner has the right to perform air and performance monitoring at any time.
 2. The Owner has unlimited access to the regulated and surrounding areas at times during progress of the Work, including, but not limited to, use of ladders, scaffolds, and other equipment required to gain access to the Work surfaces.
- B. Work Area Monitoring:
 1. Visual inspections and air testing may be performed at any time during the progress of the Abatement Work. Provide corrective measures as required to maintain the Work area in compliance with this Specification and regulatory requirements.
- C. Contractor's Employee – Personal Air Monitoring:
 1. Provide air monitoring as required California Code of Regulations, Title 8, Section 1529. Results shall be provided to the Owner Consultant within ten working days of sampling. Negative Exposure Assessments utilizing prior project monitoring require submittal of applicable data for approval before work proceeds.
- D. Clearance Air Monitoring:

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1. Following the completion of Abatement Work and clean up operations, lock down coat application, and visual inspection by the Owner, clearance air monitoring shall be performed by the Owner Consultant.
2. The Owner Consultant shall arrange for sampling of the air in the Abatement Work area for airborne fiber concentrations. Unauthorized interference or tampering with air sampling equipment may result in termination of the Contract and/or removal of the Abatement Contractor from the List of Prequalified Abatement Contractors.
3. If air-sampling results are within the limits of 40 CFR, Part 763, Subpart E (AHERA), the Abatement Work area shall be released for occupancy.
4. Areas failing clearance monitoring shall be cleaned as required in article 3.09, CLEAN UP PROCEDURES, and tested until satisfactory levels are provided in accordance with this Specification where required.

3.14 RE-ESTABLISHMENT OF THE WORK AREA AND SYSTEMS

- A. Reestablishment of the Work area shall only occur following the completion of final inspection and clearance air monitoring.
- B. Critical barriers shall be removed at this time.
- C. Accompanied by the Owner Consultant, visually inspect the Abatement Work area for any remaining visible residue. Evidence of contamination will require additional cleaning requirements.
- D. Install and secure Moveable Objects.
- E. Relocate Moveable Objects that were removed to temporary locations back to their original positions.
- F. Reestablish HVAC, mechanical, and electrical systems to the condition prior to commencement of the Work of this section.
- G. Repair areas of damage deemed to be a result of the Abatement Work.
- H. Restore the Work area and auxiliary areas utilized during the Abatement to conditions equal to or better than original. Any damage caused during the performance of Abatement Work, including, but not limited to, damage caused by tape, adhesive, staples, nails, water, Encapsulating Material, or any other material shall be repaired as required.
- I. Prior to occupancy of a space following clearance monitoring, HVAC systems filters associated with the Work area shall be removed and disposed of as Asbestos waste. Decontaminate filter assembly and surrounding area with HEPA Vacuums and wet cleaning methods.

END OF SECTION

SECTION 02 8333 - LEAD ABATEMENT AND LEAD RELATED CONSTRUCTION WORK

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Abatement, Lead Related Construction Work or painting of lead-containing materials and/or Lead Based Paint.
2. Transportation and disposal of lead-containing materials and/or Lead Based Paint.

B. Related Requirements:

1. Section 00 3126 - Existing Hazardous Materials Information.
2. Division 01 - General Requirements.
3. Cal/OSHA Title 8, California Code of Regulations (CCR).
4. California Air Resources Board Ambient Air Quality Standard, Title 24 CCR.
5. California Department of Public Health, Title 17, CCR.
6. Cal/EPA, Title 22 CCR.
7. California Labor Code, Division 5, Part 1, as it pertains to safety in employment and with the applicable provisions of the Title 8, CCR as it pertains to Occupational Safety and Health in the work place.
8. Environmental Protection Agency, 40CFR, Part 745.
9. UD – Title X, Residential Lead-Based Paint Hazard Reduction Act of 1992.
10. Los Angeles County Public Health Code (Chapter 11).

1.02 DEFINITIONS AND ACRONYMS

- A. AAS - Atomic Absorption Spectrophotometry used for lead paint chip and dust wipe sample analysis.
- B. Abatement – Any set of measures designed to reduce or eliminate lead hazards or Lead Based Paint for public and residential buildings, but does not include containment or cleaning.
- C. Action Level – Means the Action Level as defined in Title 8, California Code of Regulations, Section 1532.1.
- D. ANSI – American National Standards Institute.
- E. ASTM – American Society for Testing and Materials.

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- F. Building ID number or code (Maximo) – A six digit alphanumeric identification code assigned to each building on an Owner site, also referred to as the insurance code, ID number or similar terms.
- G. Certificate – Means the document issued by CDPH to an individual meeting the certification requirements as described in CCR Title 17, Sections 35083, 35085, 35087, 35089, or 35091.
- H. Clean Room – An uncontaminated area or room which is a part of the worker Decontamination Enclosure System with provisions for storage of worker's street clothes and clean protective equipment.
- I. Clearance Inspection – Means visual examination and, as applicable, collection of environmental samples upon completion of the Work of this section.
- J. Component – Means a structural element or fixture, including but not limited to, walls, floors, ceilings, doors, window molding, trim, trestles, tanks, stairs, railings, cabinets, gutters, or downspouts.
- K. Curtained doorway – A device to allow ingress and egress from one room to another while permitting minimal air movement between the rooms, typically constructed by placing two overlapping sheets of plastic over an exiting or temporarily framed doorway, securing each along the top of the doorway, securing the vertical edge of one sheet along one vertical side of the doorway and securing the vertical edge of the other sheet along the opposite vertical side of the doorway. Other effective designs may be submitted for review.
- L. Decontamination – The process of eliminating lead contamination from building surfaces, and property by cloths, mops, or other utensils dampened with water and disposed of as lead contaminated waste.
- M. Decontamination Enclosure System – A minimum two-stage Decontamination unit consisting of a compartment for Decontamination, and a Clean Room. Unless otherwise specified, it shall be adjacent to the Abatement area.
- N. Demolition – The wrecking or taking out of any load supporting structural member of a facility together with any related handling operations.
- O. Deteriorated Lead Based Paint – Means Lead Based Paint or a surface coating that is cracking, chalking, flaking, chipping, peeling, non-intact, failed, or otherwise separating from the substrate to which it is applied to.
- P. CDPH– California Department of Public Health.
- Q. CDPH-Approved Course – Means any lead construction course that satisfies the requirements specified in CCR Title 17, Sections 35056, 35061, 35066, or 35067 as determined by CDPH pursuant to Sections 35076 and 35078.
- R. DOSH – California Division of Occupational Safety & Health or Cal/OSHA.
- S. DOT – Department of Transportation.
- T. DTSC – California Department of Toxic Substances Control.
- U. Encapsulating Material – Are coatings or rigid materials adhesively applied to Lead Based Painted surfaces in the Encapsulation process.

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- V. Encapsulation – The application of an Encapsulating Material to Lead Based Paint to provide a barrier between the Lead Based Paint and the environment.
- W. Enclosure – A rigid durable barrier mechanically attached to building Component, with edges and seams sealed with caulk or other sealant.
- X. EPA; Renovation, Repair and Painting (RRP) – Means a lead-related construction course that satisfies the requirements specified in 40 CFR, Part 745, Section 745.90.
- Y. FETU – Facilities Environmental Technical Unit.
- Z. Firm – Means a company, partnership, corporation, sole proprietorship or individual doing business, association, or other business entity; a Federal, State, Tribal, or local government agency; or a nonprofit organization and satisfies the requirements specified in 40 CFR, Part 745, Section 745.89.
- AA. Fixed Object – A piece of equipment, furniture, or improvement in the Work Area, which cannot be removed from the Work Area.
- BB. Hazardous Waste – Means any waste stream determined by an Owner approved laboratory to exceed the regulatory thresholds for lead hazardous waste.
- CC. HEPA Filter – Means a filtering system capable of trapping and retaining at least 99.97 percent of mono-dispersed particles 0.3 micrometers in diameter or larger.
- DD. HEPA Vacuum – A vacuum system furnished with HEPA filtration.
- EE. HUD – United States Department of Housing and Urban Development
- FF. HVAC – Heating, Ventilation, and Air Conditioning system.
- GG. ICP-AES – Means Inductively Coupled Plasma-Atomic Emission Spectroscopy used for heavy metal analysis, including lead.
- HH. Lead Based Paint – Means paint or other surface coatings that contain an amount of lead equal to or greater than 0.7 milligrams per square centimeter (0.7 mg/cm²) or equal to or greater than 0.5 percent by weight.
- I. Lead Containing Paint – Means paint or other surface coatings that contain lead in an amount equal to or greater than 0.06 percent lead dry weight (600 ppm) but does not meet the definition of Lead Based Paint. In the absence of paint chip or surface coating bulk sample results, any surface coating shall be assumed to be above 0.06 percent lead dry weight (600 ppm) until surface coating samples are collected and analyzed that indicate otherwise. Lead concentration shall be determined by a method that has an accuracy of not less than plus or minus 25 percent at 0.06 percent lead dry weight, to a confidence level of 95 percent.
- JJ. Lead Contaminated Dust – Means dust that contains an amount of lead equal to, or greater than, forty micrograms per square foot (40 µg/ft²) for interior floor surfaces; two hundred and fifty micrograms per square foot (250 µg/ft²) for interior horizontal window surfaces; and eight hundred micrograms per square foot (800 µg/ft²) for exterior floor and exterior horizontal window surfaces.
- KK. Lead Contaminated Soil – Means bare soil that contains an amount of lead equal to, or greater than, four hundred parts per million (400ppm).

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- LL. Lead Hazard – Means deteriorated Lead Based Paint, Lead Contaminated Dust, Lead Contaminated Soil, the disturbance of Lead Based Paint or Presumed Lead Based Paint without containment, or any other operation that may result in persistent and quantifiable lead exposure.
- MM. Lead Inspection – Means a surface by surface investigation to determine the presence of Lead Based Paint as described in Chapter 7: Lead Based Paint Inspection, “ Guidelines for the Evaluation and Control of Lead Based Paint Hazards in Housing,” U.S. Department of Housing and Urban Development, 1997 Revision.
- NN. Lead Related Construction Work – Means any construction, alteration, painting, Demolition, salvage, Renovation, repair, or maintenance of any residential or public building, including preparation and cleanup that, by using or disturbing lead-containing material or soil, may result in significant exposure of adults or children to lead.
- OO. Lead Safe Schools Program – Means the training program for lead safe working practices as developed by the Labor Occupational Health Program at U.C. Berkley.
- PP. Location Code (Maximo) – Refers to a unique four digit numeric code assigned by the Owner to each of its Project sites.
- QQ. Member – A Component part of a structure complete in itself.
- RR. Movable Object – A piece of portable equipment or furniture in the Work Area, which can be removed from the Work Area.
- SS. NESHAP – The National Emission Standards for Hazardous Air Pollutants (40 CFR Part 50.12).
- TT. NIOSH – The National Institute for Occupational Safety and Health.
- UU. Owner Consultant (OC) – Refers to the firm, company or individual designated by the Owner.
- VV. Painting Contract – For purposes of this section, a painting contract is a Contract with the Owner to perform painting on existing facilities where Lead Based Paint, Lead Containing Paint, Presumed Lead Based or Presumed Lead Containing Paint will be disturbed or abated.
- WW. P.E.L. – Means permissible exposure limits as defined in Title 8, California Code of Regulations, Section 1532.1.
- XX. Plasticize – To cover floors, walls, and equipment with plastic sheeting as specified herein.
- YY. Portable Mechanical Ventilation System – A portable exhaust system furnished with HEPA filtration and capable of providing a constant air flow into regulated Work Area from adjacent areas and exhausted outside the regulated area.
- ZZ. Presumed Lead Based Paint – Means paint or surface coating affixed to a Component in or on a structure, excluding paint or surface coating affixed to a Component in or on a residential dwelling constructed on or after January 1, 1979, or a school constructed on or after January 1, 1993.
- AAA. Removal – Means operations where Lead Based Paint is removed or stripped from structures or substrates including Demolition.
- BBB. Renovation – Means the modifying of any existing structure, facility, or portion thereof.

- CCC. Replacement – Means Removal of an entire building Component coated with Lead Based Paint and replacing it with a lead free Component.
- DDD. SCAQMD – South Coast Air Quality Management District.
- EEE. STLC – Means Soluble Threshold Limit Concentration used in the State of California in conjunction with TTLC to determine lead hazardous waste limits. If the STLC result is equal to or exceeds 5 mg/L the waste is deemed to be hazardous.
- FFF. Surfactant - A chemical wetting agent added to water.
- GGG. TCLP – Means Toxicity Characteristic Leaching Procedure used to determine the federal Resources Conservation Recovery Act (RCRA) lead hazardous waste limits. If the results equal or exceed 5 mg/L the waste is deemed to be hazardous.
- HHH. TTLC – Means Total Threshold Limit Concentration used in the State of California in conjunction with STLC to determine lead hazardous waste limits. If the results are equal to or exceeds 1000 mg/kg, the waste is deemed to be hazardous.
- II. Visible Emissions – Any emissions from a known or suspected lead-containing material that is visually discernible.
- JJJ. Wet Cleaning – The process of eliminating lead contamination from building surfaces and/or objects by cloths, mops, or other utensils dampened with amended water and afterwards being disposed of as hazardous waste.
- KKK. Work Area – Means an area where known or Presumed Lead Based Paint is disturbed or Abatement is conducted.
- LLL. X-Ray Fluorescence (XRF) Analyzer – Means a direct reading instrument that determines the lead content of the surface coatings in milligrams per square centimeter (mg/cm²) using the principle of x-ray fluorescence.

1.03 POLICIES AND PROCEDURES

- A. The Owner has a zero-tolerance policy for uncontrolled lead releases during Lead Related Construction Work, Lead Containing Paint disturbance, or Abatement activities. A lead release requiring an emergency response is any disturbance resulting in the uncontrolled release of lead containing materials. Upon observation of any visual emissions, immediately stop the Work, vacate the Work Area, and provide written notification to the Owner Consultant.
- B. Pre-qualified Abatement Subcontractors are not permitted to subcontract any Abatement Work to a lower tier Subcontractor without the prior written approval of the Owner.
- C. Do not furnish a reduced pressurization and filtration system in violation of, or in infringement upon, any patent.
- D. Owner Consultant shall provide oversight for Projects that have the potential to disturb lead containing or Lead Based Paint. Prior to the commencement of such Work, provide written notification to the Owner Consultant.
- E. The following paragraph regarding impacts to coated surfaces shall be part of the contract:

1. “Renovation, repair or painting work performed on buildings constructed prior to 1978 require special handling and environmental monitoring when coated surfaces including, but not limited to, painted, varnished, and glazed surfaces are impacted. Coated surfaces applied prior to 1978 are assumed to be lead-based. All work shall be performed in compliance with Specification, Section 02 8333, “Lead Abatement and Lead Related Construction Work.” XRF testing methodology is not acceptable in determining negative for lead content for Cal/OSHA compliance purposes, except for notification requirements. XRF may be used in determining lead-based paint for compliance with the U.S.E.P.A. Renovator, Repair, and Painting Rule. Disturbance of coated surfaces by contractors will be monitored by qualified District staff or Environmental Consultant sufficient to ensure that proper training and work procedures, cleanup, and waste handling are employed.”

1.04 COORDINATION

- A. Coordinate the Work of this section directly with the Owner and/or Owner Consultant.

1.05 SITE SECURITY

- A. The Work Area is restricted to authorized, trained, and protected personnel. A list of authorized personnel shall be established and posted at the entrance of the Work Area by the Owner Consultant prior to commencement of the Work.
- B. Report to the Owner Consultant any unauthorized entry into the Work Area. Following notification, a written report of the incident shall be provided to the Owner Consultant.
- C. A logbook shall be maintained at the entrance of the Work Area. Persons entering the Work Area shall record name, company affiliation, time in, and time out for each entry and exit.
- D. Access to the Abatement Work Area shall be through the Decontamination Enclosure System only. Other means of access shall be blocked or locked so as to prevent entry to or exit from the Work Area. Emergency exits shall be operable from inside the Work Area.
- E. Maintain Work Area security during Abatement and/or Lead Related Construction Work. Work Areas and ancillary equipment accessible to non-authorized personnel shall be protected from unauthorized access by constructing a minimum barrier of 3/8 inch CDX plywood supported by 2 by 4 studs, 16 inches on center. An access door shall be provided with hasp and padlock sufficient to prevent unauthorized entry. A key shall be provided to the Owner and Owner Consultant. Required barriers within an occupied building shall be furnished with sheathing as required by state and local fire protection regulations.
- F. Remove barriers upon the completion of the Work of this section and unless otherwise specified, repair and/or replace to its original condition, damage resulting from installation, use, and removal of the barriers.

1.06 EMERGENCY PLANNING

- A. Emergency planning and procedures shall be developed, submitted, reviewed, and agreed to by the Owner Consultant prior to the commencement of lead-related construction and/or Abatement Work.
- B. Emergency procedures shall be provided in the written languages understood by employees working on the Project and shall be prominently posted at the entrance of the Decontamination

Enclosure System. Prior to entering the Work Area, parties must read and sign these procedures to acknowledge receipt and understanding of the Work Area layout, location of emergency exits, and emergency procedures.

- C. Emergency planning shall consider the effects of fire, explosion, toxic atmospheres, electrical hazards, slips, trips and falls, confined spaces, and heat related injury. Develop and provide written procedures and training to employees.
- D. Employees shall be trained in evacuation procedures in the event of workplace emergencies.
- E. In the event of non-life threatening situations requiring medical treatment, injured or otherwise incapacitated employees shall decontaminate following normal procedures with assistance from fellow workers if necessary, before exiting the Work Area.
- F. In the event of life threatening injury or illness requiring immediate medical treatment, worker Decontamination shall be given minimum priority. Provide measures to stabilize the injured worker remove them from the Work Area and secure proper medical treatment.
- G. Telephone numbers of emergency response personnel shall be prominently posted at the entrance of the Decontamination Enclosure System along with the location of the nearest telephone. In addition to the 911 emergency number, post the address and telephone number of the nearest emergency medical services provider.
- H. Provide at least one employee on the Project site at times during progress of the Work that is trained and certified in first aid and cardiopulmonary resuscitation (CPR). This employee shall be identified by name and proof of training shall be provided to the Owner Consultant prior to the commencement of the Work of this section.
- I. Provide at least one 4A/60BC dry chemical extinguisher in the Decontamination compartment. Workers shall be trained in the proper operation of fire extinguishers.
- J. Emergency exits shall be provided and clearly marked with arrows or other clearly visible markings to permit easy identification from anywhere within the Work Area. Exits shall be secured to prevent access from uncontaminated areas while still permitting emergency egress. Exits shall be properly sealed with polyethylene sheeting, which can be cut to permit emergency egress. Emergency exits may lead through the Decontamination Enclosure System or other alternative exits as required by fire officials.

1.07 LICENSING

- A. The Work of this section shall be performed by an entity duly licensed in the State of California in accordance with the provisions of Chapter 9 of Division 3 of the Business and Professions Code, as amended.

1.08 QUALIFICATIONS

- A. Only safety pre-qualified bidders on the pre-approved bidders list are qualified to be awarded an Abatement Contract or Painting Contract be listed as a Subcontractor for lead Abatement Work or Painting Contract.
- B. Where the scope of the Work includes the painting and/or refinishing of existing surfaces, only safety pre-qualified bidders on the pre-approved bidders list are qualified to be awarded a painting Contract or be listed as a Subcontractor for painting Work.

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- C. Before any workers perform Abatement Work or Work of this section where the P.E.L. is exceeded, submit proof of CDPH training and certification. No Work shall be performed until the Owner Consultant has reviewed and approved CDPH training and certifications.
- D. Workers shall be in personal possession of a wallet CDPH certification card at times while they are performing Abatement Work on the Project site.
- E. Workers performing lead Abatement, Lead Related Construction Work, or disturbance of Lead Containing Paint where the exposure level exceeds the P.E.L., shall possess current CDPH certification and at least one CDPH Certified supervisor shall be available as required by Title 17, CCR subsection 36100.

1.09 TRAINING

- A. Lead Related Construction Work shall be performed by personnel with the following training, as applicable:
 - 1. The Lead Related Construction Work, specified herein, shall be performed by individuals trained and qualified in the techniques of lead-related construction, handling, disposal of lead-based and Lead Containing Paint, and the subsequent cleaning of contaminated areas. These individuals must comply with the applicable Environmental Protection Agency (EPA), Renovation, Repair and Painting (RRP) programs lead-related construction course that satisfies the requirements specified in 40 CFR, Part 745, Section 745., and must be capable of and willing to perform the Work of this section.
 - 2. The Lead Related Construction Work, specified herein, shall be performed by a company, partnership, corporation, sole proprietorship or individual doing business, association, or other business entity; a Federal, State, Tribal, or local government agency; or a nonprofit organization, shall satisfy the requirements specified in 40 CFR, Part 745, Section 745.89, as a Lead-Safe Certified Firm.
 - 3. Lead Abatement Work, specified herein, shall be performed by individuals trained and qualified in the techniques of lead abatement and will receive CDPH accredited training and certification, and must be capable of and willing to perform the Work of this section.
 - 2. Training specific to the performance of Lead Related Construction Work shall be provided to employees prior to performing the Work of this section.
 - 3. Training specific to the operation and use of fire extinguishers.

1.10 EXPOSURE ASSESSMENT

- A. Disturbance of Lead Containing Paint, as defined in this Specification, disturbed by tasks not included in Title 8, CCR Section 1532.1, Subsection (d)(2), shall require worker-exposure monitoring upon initiation of the Work. The workers performing these tasks shall be trained in accordance with the Hazard Communications Standard, Section 5194, including but not limited to, the requirements concerning warning signs and labels, Safety Data Sheets (SDS), and employee information and training.
- B. Provide an exposure assessment where the workers are performing Lead Related Construction Work. If historical data, collected within the 12 months prior to the Work performed, indicates worker exposure is below the P.E.L., and the Work being performed closely resembles the process, type of material, control methods, work practices, and environmental conditions, additional exposure assessment is not required.

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- C. For Lead Related Construction Work where there is objective data or an exposure assessment demonstrating that the Lead Based Paint, or a specific process, operation or activity other than Abatement involving lead cannot result in employee exposure to lead at or above the P.E.L. during the specific process or handling, employees trained as required by Title 8, CCR Section 1532.1, including the training topics of the Lead-Safe Schools Program, may perform the Lead Related Construction Work.
- D. Where Work being performed indicates an exposure above the Action Level, each employee is required to have current blood lead level and Zinc Protoporphorin testing, medical clearance for negative pressure respirator use, and respirator fit testing.
- E. If there is no objective data or a negative exposure assessment fulfilling the above requirements, Lead Related Construction Work identified as a trigger task by Title 8, CCR 1532.1 shall be performed by workers who have received training as required by Title 8 CCR, Section 1532.1. This training shall, at a minimum, include the training topics of the Lead Safe Schools Program. An exposure assessment is required to be performed upon initiation of Work.
- F. The required exposure assessment shall not exceed 12 months from the date the samples were collected to the date the Lead Related Construction Work or disturbance of Lead Containing Paint is performed.
- G. The submission and review by the Owner Consultant of the objective data or exposure assessment is required prior to performing Lead Related Construction Work.

1.11 SUBMITTALS

- A. Provide in accordance with Division 01 and this section.
- B. Prior to performing the Work of this section, submit the following procedures to the Owner Consultant:
 - 1. An abatement plan including, but not limited to:
 - a. A detailed written description of the measures and management procedures, including the containment that will be utilized during Abatement to prevent exposure to lead hazards. Shop Drawings shall indicate the containment locations.
 - b. A detailed written description of the Abatement, including methods of Abatement, locations of rooms and building Component where Abatement is planned.
 - 2. Required air monitoring procedures (Cal/OSHA mandatory and SCAQMD permits for air filtering equipment).
 - 3. Decontamination procedures for personnel, Work Area, and equipment.
 - 4. Procedures for handling and disposing of waste materials, including disposal facility.
 - 5. Provide the procedures to be used for capturing debris while disturbing overhead materials.
 - 6. Procedures for final Decontamination and cleanup.

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7. Procedures for dealing with heat stress during Abatement.
 8. Emergency procedures during Abatement.
- C. Prior to performing Abatement Work of this section, submit the following Shop Drawings to the Owner Consultant:
1. Preparation of Work Area.
 2. Layout and construction of Decontamination Enclosure System and barriers for isolation of the Work Area described in this Specification and required by applicable regulations.
- D. Prior to performing the Work of this section, submit the following Product Data to the Owner Consultant:
1. Product Data relative to personal protective equipment including respiratory protection and protective clothing.
 2. Material safety data sheets and technical specifications for proposed materials.
- E. Prior to performing the Work of this section, submit the following notifications to the Owner Consultant:
1. Evidence of notification to Cal/OSHA as required by Title 8 CCR, Section 1532.1, where applicable.
 2. Notify CDPH no less than five days in advance of Abatement by submitting an Abatement of Lead Hazard Notification, CDPH Form 8551.
- F. Prior to performing the Work of this section, submit the following documentation to the Owner Consultant:
1. A list of employees who will participate in the Project, including delineation of experience, training, and assigned responsibilities during the Project.
 2. Submit proof satisfactory to the Owner Consultant that required permits, site location, and arrangements for transport and disposal of lead containing waste has been performed in accordance with Federal, State, and local regulations.
 3. Submit proof of training for each worker who will perform Abatement or Lead Related Construction Work.
 4. Submit manufacturer's certification that HEPA Vacuums, air filtration units and other local exhaust ventilation equipment conform to ANSI Z9.2, as applicable.
 5. When HEPA Vacuums are utilized on the Project, provide the maintenance and filter change log for these before they are brought onto the Project site.
 6. Provide the current SCAQMD permit for each HEPA Vacuum and Portable Mechanical Ventilation System before they are brought onto the Project site.
 7. Where biological monitoring is required, submit test result documentation verifying employees have completed blood lead level and Zinc Protoporphorin tests in accordance with Title 8 CCR, Section 1532.1.

8. Workers are required to submit a signed Code of Conduct form.
- G. Prior to performing the Work of this section, submit the following Samples to the Owner Consultant:
1. Submit a Sample of forms to be used in documenting the Work of this section.
- H. Prior to performing the Work of this section, submit the following schedule to the Owner Consultant:
1. An intended sequence of Work and construction schedule. Coordinate both the sequence and durations with the Owner.
- I. Prior to performing the Work of this section, submit other required items to the Owner Consultant.
- J. During the performance of the Work of this section, submit the following documentation to the Owner Consultant:
1. Submit documentation from a physician certifying that employees who wear a negative pressure respirator are medically cleared to do so without suffering adverse health effects as required by DOSH regulations. The certification shall state that the employee or agent may perform Lead Related Construction Work and wear a negative pressure respirator without restrictions. Provide information to the examining physician about unusual conditions in the workplace environment that may impact the employee's ability to perform Work activities.
 2. During the performance of the Work of this section, and before additional supervisors or workers are permitted to perform the Work of this section, submit proof of CDPH training and certification, where applicable. No additional supervisors or workers are permitted upon the Project site until the Owner Consultant has approved the CDPH training and certifications, when required.
 3. Submit weekly job progress reports detailing Abatement and Lead Related Construction Work activities for Projects that will exceed thirty days. Include review of progress with respect to previously established Milestones and schedules, major problems and action taken, injury reports, equipment breakdown, and air and/or wipe sampling results.
 4. Within five workdays of transport and disposal, submit copies of transport manifests, disposal receipts, analytical data, and weight certificates for hazardous waste removed from the Work Area during the Lead Related Construction Work and/or Abatement Work. Weight certificates shall indicate by pounds the net weight of waste disposed of from the Project site as indicated on the associated manifest.
 5. Submit daily, copies of Abatement Work site entry logbooks with information on worker and visitor access.
 6. Submit logs on a weekly basis documenting filter changes on respirators, HEPA vacuums, HEPA filtered ventilation units, water filtration units, and other approved engineering controls, as applicable.
 7. Submit results of air and/or wipe sampling data (as applicable) collected during the course of the Abatement and Lead Related Construction Work including DOSH compliance air monitoring results.

- K. During the performance of the Work of this section, submit other required items.

1.12 PRE-ABATEMENT MEETING

- A. Attend a meeting to be held prior to the commencement of the Work of this section. Attending this meeting shall be representatives of the Owner, the Owner Consultant if applicable, and the testing and monitoring personnel who shall actually participate in the testing and monitoring program. Secure the attendance of the individual who will be the Project site competent person for the Abatement Work.
- B. At this meeting provide required submittals except for those to be submitted during progress of the Work. In addition, provide detailed information concerning:
 - 1. Preparation of Work Area and Shop Drawings.
 - 2. Personal protective equipment, including respiratory protection and protective clothing.
 - 3. Employees who will participate in the Project, including delineation of experience, training, and assigned responsibilities during the Work.
 - 4. Decontamination procedures for personnel, Work Area, and equipment.
 - 5. Abatement methods and procedures to be provided.
 - 6. Required air monitoring procedures (pre-Abatement, Cal/OSHA mandatory, and SCAQMD requirement).
 - 7. Procedures for handling and disposing of waste materials, including disposal facility.
 - 8. Procedures for final Decontamination and cleanup.
 - 9. A sequence of Work activities and performance schedule.
 - 10. Procedures for dealing with heat stress.
 - 11. Emergency procedures.

PART 2 – PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Products: The following products have been specifically approved for use as encapsulants/lock-down or bridging agents for Owner asbestos abatement and asbestos related construction projects and lead abatement and lead abatement related construction projects. Products not approved by the Owner shall not be used.
 - 1. L-B-C Lead Barrier Compound 5400 by Fiberlock Technologies, Inc.; coating encapsulant.
- B. Materials:
 - 1. Deliver materials in the original sealed packages, containers, or bundles bearing the name of the manufacturer and brand name.

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2. Store materials, subject to damage off the ground, away from wet or damp surfaces, and under cover sufficient enough to prevent damage or contamination. Replacement materials shall be stored outside of the Work Area until area is cleared for normal occupancy.
3. Damaged, deteriorating, or previously used materials shall not be furnished and shall be removed from the Project site and legally disposed of.
4. A sufficient supply of disposable mops, rags, and sponges for Work Area Decontamination shall be provided.
5. Unless otherwise specified, the Owner will provide water for construction purposes. Connect to existing system as required.
6. Products brought onto the Project site shall be accompanied by their respective Material Safety Data Sheet, which shall be maintained on the Project site.
7. Plastic, polyethylene sheeting or visqueen shall be a fire retardant type. Provide documentation from the manufacturer verifying compliance with this requirement.
8. Polyethylene sheeting furnished for the Decontamination Enclosure System shall be opaque white or black in color and shall be a minimum of 6-mil thick.
9. Surfactant (wetting agent) shall be a material that, when tested, demonstrates a surface tension of 29 dynes/cm as tested in its properly mixed concentration, using ASTM method D1331-56-"Surface and Interfacial Tension of Solutions of Surface Active Agents." Where Work Area temperature may cause freezing of the Amended Water solution, the addition of approved antifreeze in a manufacturer recommended amount is permitted.

B. Equipment:

1. Disposal bags shall be of 6-mil polyethylene, pre-printed with labels as required by applicable Cal/OSHA and DOT requirements.
2. Provide labels as per DOT requirements for disposal containers.
3. Provide warning signs as required by Cal/OSHA.
4. Disposal containers shall meet requirements of Title 22, CCR.
5. Provide a sufficient supply of scaffolds, ladders, lifts, and hand tools, as needed to complete the Work.
6. Provide sprayers with pumps capable of providing amended water in sufficient quantity to adequately wet the material to be abated or for Lead Related Construction Work.
7. Provide a sufficient supply of HEPA filtered vacuums to maintain a clean environment in compliance with this section.
8. When an enclosure requiring negative pressure is specified, a sufficient quantity of air-filtration ventilation units furnished with HEPA filtration and operated in accordance with ANSI Z9.2 and EPA guidance documents shall be utilized to provide one workplace air change every 15 minutes and creating a pressure differential of -0.02 inches of water everywhere within the enclosure when compared to the area outside the enclosure. A log

documenting the filter change history of each unit shall be required before use, and any unit without this log shall have filters changed and the unit decontaminated.

9. When rental equipment is to be used in Abatement areas or to transport lead contaminated waste, a written notification concerning the intended use of the rental equipment shall be provided to the rental agency with a copy submitted to the Owner.
10. When performing chemical Removal, provide portable eyewash station(s) that meet ANSI standards and are accessible to workers within 10 seconds.
11. Additional safety equipment, as necessary, shall be provided to workers and authorized visitors.
12. Equipment delivered to the Project site shall be free of debris suspect of containing lead. No equipment with suspect debris in or on it shall be permitted on Owner properties and/or the Project site.
13. When roll-off disposal containers are delivered to a Project site, four wheels of each container shall be moved and rested upon a minimum size sheet of plywood of 4-foot by 4-foot by $\frac{3}{4}$ inch.
14. Lighting shall be provided in an amount sufficient to illuminate the Work Area for the purpose of safe visual working conditions and to permit examination of surfaces where Work is performed.

2.02 EMPLOYEE PERSONAL PROTECTIVE EQUIPMENT

A. Respiratory Protection:

1. Submit NIOSH approvals for respiratory protective devices utilized on the Project site. Include manufacturer certification of HEPA filtration capabilities for cartridges and filters. Filter cartridges shall be furnished with the NIOSH P-100 designation.
2. Provide respiratory protection to employees in compliance with CCR Title 8, Sections 1532.1 and 5144, as determined by the employee exposure assessment.
3. In the absence of an exposure assessment, base respiratory protection on the requirements of Title 8, CCR Section 1532.1, specifically subsection (d).
4. In addition to P-100 filters, provide the appropriate respirator filter cartridges for exposure to other airborne contaminants generated during the Abatement process.
5. Provide authorized visitors with a respirator and cartridges sufficient to protect individuals from exposure to hazardous environments generated during the Abatement activity.

B. Fit Testing:

1. Perform fit testing in accordance with Title 8 CCR, Section 5144.
2. Submit documentation of respirator fit testing for individuals entering the Work Area.
3. Maintain and submit to the Owner a copy of the written respiratory protection program.

C. Personal Protective Clothing and Equipment:

1. Provide eye protection to employees sufficient to protect employees from debris during work progress when full-face respirators are not being utilized.
2. Provide and require the use of eye protection when employees are working with a material that may splash or fragment, as specified by the Material Safety Data Sheet for a given product, or as required by Title 8, CCR.
3. Spectacle kits and eyeglasses must be provided for employees who wear glasses and who must wear full-face piece respirators. Provide respirators that have been tested and approved by the National Institute of Occupational Safety and Health for use in lead-contaminated atmospheres.
4. Provide full-body disposable protective clothing, including head, body, and foot coverings to workers and authorized visitors who enter the Work Area, in sizes adequate to accommodate movement without tearing. A new suit shall be provided and donned for each separate entry.
5. If washable clothing is to be worn underneath disposable protective clothing, it shall be provided to Abatement workers.
6. Provide a clean staging area for workers and others to store street clothes and personal protective equipment.
7. Disposal suits shall be collected in an appropriate disposal container at the entrance of the Abatement Work Area.
8. Abatement workers are required to wear nonskid footwear sufficient to protect them from workplace hazards. Disposable clothing shall be adequately sealed to the footwear to prevent body contamination.
9. Hand protection shall be provided, and workers shall be required to use lotion sufficient quantities to protect the worker when chemicals or other physical hazards exist.
10. As required by the Work site and applicable safety regulations, provide head protection and require the use thereof.
11. Worker protection equipment shall be ANSI approved.

PART 3 - EXECUTION

3.01 LEAD RELATED CONSTRUCTION WORK

A. Work Area Preparation and Work Practices:

1. Where exposure monitoring indicates Worker exposure is below the P.E.L., comply with the requirements of this section and the "Monitoring" section of this Specification.
2. Disturbance of lead containing materials shall be performed using wet methods.
3. Work requiring overhead disturbances shall require a means of capturing debris, thus preventing an uncontrolled release on the worker or the surfaces below.

4. For disturbances utilizing local exhaust dust collection devices the equipment shall be designed and furnished with a HEPA filtered vacuum attachment approved by the manufacturer.
5. Where Components are to be removed, loose Lead Based Paint and Lead Containing Paint shall be removed by manual means using wet methods.
6. Where a Component is attached and painted onto another surface and the Component is to be removed from the adjoining surface the paint shall be cut with a razor knife to reduce the potential of paint chip debris during Component removal.
7. If a Component being removed will be disposed of rather than reinstalled, manually cut the Component into manageable sections for disposal using wet methods or mechanically cut using a manufactured approved HEPA filtered local exhaust dust collector.
8. If a Component is to be reused, loose paint or rough edges may require scraping or sanding. Scraping or sanding must be performed manually using wet methods or mechanically with a manufactured approved HEPA filtered local exhaust attachment.
9. For solid core surfaces where penetration or welding are required the lead containing material shall be removed from the area impacted using wet methods. Layers of Paint shall be removed before impact to the surface commences.

B. Clean Up Procedures:

1. During the entire process of Lead Related Construction Work, clean debris generated using wet methods and/or HEPA Vacuuming.
2. At the completion of the Lead Related Construction Work, clean surfaces within the impacted Work Area.
3. When HEPA filtered Vacuums are utilized, vacuum from the area of impact to the outer perimeter of the polyethylene sheeting to remove visible debris. If vacuuming cannot remove visible debris, wet wiping will also be required.
4. When wet wiping the Work Area, wipe from the area of impact to the outer perimeter of the polyethylene sheeting to remove visible debris.
5. Tools and equipment utilized in the Work Area shall be wet wiped to remove visible debris.

3.02 ABATEMENT

A. Work Area Preparation:

1. Clean areas to be isolated by HEPA Vacuum prior to installation of polyethylene sheeting.
2. Seal the Work Area with a layer of 6 mil thick polyethylene sheeting prior to any Lead Based or Lead Containing Paint Removal or disturbance by covering vents, windows, door openings, and any non-Moveable Objects such as lockers, etcetera.
3. Install a minimum of two layers of 6 mil thick polyethylene sheets on floors, fastened by waterproof tape and other means as necessary to secure the sheeting.

4. The covering on windows, exterior doors, and vents shall be installed from the outside to facilitate Work on them from the inside.
- B. Decontamination Enclosure System:
1. At a minimum a two-stage Decontamination Enclosure System consisting of a compartment for Decontamination and a Clean Room shall be constructed and used.
 2. Unless otherwise specified, the Decontamination Enclosure System shall be adjacent to the Abatement area.
 3. Other enclosure methods may be used if submitted and approved by the Owner Consultant.
- C. Removal and Replacement Substrates with Lead Based Paint:
1. Except as noted in the Specifications and Drawings, replace substrate with material of the same or better quality. Substrates include, but are not limited to doors, windows, moldings, casements, mantels, trims, skirting, baseboards, and associated hardware and fasteners.
 2. Areas adjacent to substrate removal shall be protected from damage. Damages shall be repaired or replaced to original condition.
 3. Substrates that are removed for replacement shall be wrapped and stored for disposal. Disposal shall be in accordance with the applicable codes and sections of this Specification.
 4. After removal, the areas disturbed shall be cleaned and a Clearance Inspection performed in accordance with the procedures described in this Specification.
- D. Abrasive Removers – Machine Sanders:
1. Machine sanders shall be furnished with a HEPA Vacuum system approved by the manufacturer.
 2. Sanding shall only be performed on flat surfaces that allow the HEPA Vacuum dust collection attachment to come into tight contact with the surface being sanded.
 3. Remove Lead Based Paint down to the bare substrate surface. If the pigment cannot be removed without damaging the substrate, submit a Request for Clarification to the Owner Consultant.
 4. Protect adjacent surfaces from damage from machine sanding. Repair and/or replace damaged surfaces.
- E. Chemical Removal-On-Site Chemical Removal:
1. No chemical Removal shall be performed on interior surfaces unless specifically called for and designed in the Specifications or the Abatement plan of the Project.
 2. Owner approved chemical removers shall be compatible with and harmless to the substrate. On masonry surfaces chemical removers shall contain anti-stain formulation that inhibits discoloration.

3. Chemical Removal Agent Neutralizer: Use chemical Removal agent neutralizers on exterior surfaces only. Neutralizers shall be compatible with and not harmful to the substrate. Neutralizers shall be compatible with the Removal agent that has been applied to the surface substrate.
 4. Apply chemical Removal agents and neutralizers in accordance with the recommendations of the manufacturer and the following:
 - a. Adhere to health and safety regulations and other Specification section requirements. Stripping agents shall not be allowed to penetrate wood or other fibrous substrates.
 - b. Remove the softened paint by scraping or wire brushing.
 - c. Protect adjacent areas from damage from Removal agent during the course of Work.
- F. Chemical Removal – Off-Site Chemical Removal – Structures of Historical Significance Only:
1. Remove and transport Lead Based Painted Component in accordance with this Specification. Transport the Component to an off-site location. Remove Lead Based Paint by chemical Removal. Neutralize and clean the Component. Return Component to the Project site free of lead-containing materials and reinstall.
 2. Take extreme care in removing component to be taken off-site, to prevent damage. In addition:
 - a. Component shall be marked and identified using an inconspicuous engraving, to insure reinstallation in original location.
 - b. Hardware associated with a component shall be bagged and marked.
 - c. If required, hardware shall be chemically stripped, cleaned, or reconditioned.
 - d. Dispose of hazardous waste generated by the off-site stripping of Lead Based Paint as required by federal, state, and local regulations.
 - e. Do not transport hazardous waste to Owner properties and/or facilities.
 - f. Protect the component and the adjacent areas from which component are removed from damage by the removal and reinstallation procedures.
- G. Water Jet Washing:
1. The purpose of the Water Jet Washing process is to remove Lead-Based and Lead Containing Paint from exterior masonry substrate.
 2. If this procedure is selected, submit a Work plan to the Owner Consultant which includes, but is not limited to, interim controls, paint stabilization, and capture of waste water.
- H. Encapsulation – Interior and Exterior - Coated Sealer System:
1. Materials: - Elastic acrylic coating shall be heavy bodied and warranted by the manufacturer to be compatible with the substrate. Elastic acrylic coating shall be long lasting and resist cracking, peeling, algae, and fungus.

2. Submittal: - Submit two Samples, 5 ½-inch by 8-inch of the encapsulation material to the Owner Consultant.
 3. Encapsulation coatings shall be applied in accordance with the manufacturer's recommendations and the following conditions:
 - a. Remove surface dust and debris by scrubbing with a non-residue detergent solution, and rinsing. Remove loose paint until a sound, intact edge is achieved. Remove and replace loose plaster prior to the coating application. Proper safety procedures and lead dust control method in this Specification must be utilized.
 - b. Apply Encapsulation coatings to the substrate in a continuous coat to seal the surface being coated. The number of coats required and coverage rates shall be in accordance with the manufacturer's recommendations.
 - c. Repair materials that lift and peel after the application of the Encapsulation coating by scraping until a sound surface is obtained. The edges shall be feathered, and a reapplication of an Encapsulation coating shall be applied.
 - d. Remove, or cover as directed, existing fixtures located on surface to be coated, including but not limited to, electrical receptacles, switches, exhaust fans, and hardware.
 - e. Protect adjacent surfaces and existing fixtures from damage by coating system. Damages to adjacent surfaces and existing fixtures due to lack of protection or improperly applied protection shall be repaired and/or replaced.
- I. Encapsulation – Interior and Exterior - Flexible Wall Covering:
1. Materials: Wall covering shall be a reinforced fiber type that forms a secure bond with the substrate, resistant to peeling and formation of mold. The wall covering system shall form a seal over the substrate to which it is applied and not allow the passage of substrate dust into the environment.
 2. Submittal: Prior to the start of Work, submit to the Owner Consultant for approval, manufacturer's descriptive literature, and two 5 ½-inch by 8-inch Samples of each wall covering system.
 3. Install Encapsulation covering in accordance with manufacturer's installation instructions and the following provisions:
 - a. Remove foreign material by washing surfaces with a detergent solution. Remove loose plaster, loose paint, and loose wallpaper. Utilize dust control methods described in this Specification.
 - b. Repair larger damaged areas flush with surrounding wall surfaces prior to installation of wall covering system.
- J. Enclosure Procedures - Gypsum Wallboard (interior surfaces only), plywood paneling, other enclosures of exterior substrate:
1. Surface preparation: Remove foreign material by wash-down with a non-residue detergent solution. Remove loose plaster, loose paint, and loose wallpaper in accordance with this Specification to stabilize the painted surfaces.

2. Affix warning labels stating surface contains “LEAD-BASED PAINT” to the surface prior to being enclosed. Labels shall be 3-inch by 5-inch and placed four feet apart at approximately five foot high on the surface being enclosed.
3. Install selected enclosure material in accordance with the relevant section of the Specification. Any disturbance to Lead Based Paint in the execution of this section shall comply with the Lead Related Construction Work section of this Specification.

K. Soil Abatement:

1. Surface Contamination:

- a. Remove Lead Contaminated Soil from the locations and to a depth specified in the scope of Work.
- b. In the absence of a specified depth of soil removal identified in the scope of Work, submit, prior to the bid, a Request for Clarification regarding the quantity of soil to be removed.
- c. Submit a written soil abatement plan prior to initiation of the Project.
- d. No soil abatement shall proceed until the Work plan has written approval by the Owner Consultant.
- e. Refer to the waste handling and transportation section of this Specification for the handling, characterization, and disposal of waste.

L. Alternate Procedures:

1. If specified procedures cannot be utilized, a request must be made in writing to the Owner Consultant establishing details of the problem encountered and recommended alternatives.
2. Alternate procedures shall provide equivalent or greater protection than procedures that they replace.
3. Prior to implementation, alternative procedures shall be submitted and approved in writing by the Owner Consultant.

M. Clean Up Procedures

1. During the entire process of the Work of this section, perform continuous cleaning of debris generated using wet methods and/or HEPA filtered vacuuming.
2. At the completion of the Work of this section, clean surfaces within the impacted Work Area, including but not limited to, tools, equipment, and polyethylene sheeting to remove visible debris from the Work Area.
3. Tools and equipment utilized in the Work Area shall be thoroughly cleaned. Non-electrical tools and equipment shall be cleaned monthly and before Removal from the Work Area by HEPA vacuuming and washing using a lead specific detergent or other suitable cleaning agent.
4. Electrical tools and equipment shall be HEPA vacuumed and cleaned by wet wiping limiting the amount of water used to avoid electrical hazards.

5. Remove polyethylene sheeting, except for critical barriers, by folding it into itself beginning with the higher level polyethylene first.
6. Following Removal of polyethylene sheeting a final cleaning of surfaces in the Abatement workspace shall be performed by HEPA vacuuming, wet wiping, and a final HEPA vacuuming.
7. When HEPA vacuums are utilized, vacuuming shall be performed from the top down and from the area of impact to the outer edge of the polyethylene sheeting.
8. Apply no less than one continuous coat of approved paint or primer to abated surfaces, where applicable.
9. At the completion of the final clean up, the CDPHcertified supervisor shall inspect the Work Area for visible debris. If debris is identified, repeat the final cleaning process.
10. Wet wiping, washing, and cleaning required by this section shall include the Removal of visible debris by cleaning with a lead specific detergent or other suitable cleaning agent in clean water followed by a rinsing with clean water and clean rags, following the same sequence of cleaning as the vacuuming.
11. Refer to the waste handling and transportation section of this Specification for disposal of waste generated by this process.

3.03 WASTE HANDLING AND TRANSPORTATION

A. Characterization of Waste:

1. Until analytical results are available, waste materials (including water containing paint chips) shall be treated as hazardous. Visible paint chips shall be separated from waste water before characterization. Following removal of solids the waste water shall be characterized to determine disposal requirements. The paint chips removed from the waste water may be disposed of as assumed RCRA hazardous waste or characterized to determine disposal requirements.
2. Characterize waste streams as follows:
 - a. Collect a representative sample of the waste material.
 - b. For a pile of waste take one sample of a proportionate combination of Component in the pile. If a large quantity of waste is generated no less than four samples may be required.
 - c. For large wood Component, such as windows, doors, etcetera, a representative sample of each Component of similar characteristics, paint history, etcetera, shall be collected and tested. A full depth core sample, not less than one inch diameter, of the Component is to be collected. The core sample shall include the substrate and paint coatings on both sides of the Component, as applicable.
3. Analysis for the waste characterization samples shall be performed as follows:
 - a. Waste generated by chemical stripping shall, in addition to the requirements for determining the solid and soluble lead concentrations, shall be tested for

corrosiveness and other contaminants, as applicable, resulting from the chemical stripping process.

- b. Analyze samples for Total Threshold Limit Concentration (TTLC):
 - 1) If results are less than 50 mg/kg (milligrams/kilogram) the waste is not hazardous and shall be disposed as general construction waste.
 - 2) If sample results are 50 mg/kg or greater, the waste shall be tested for Soluble Threshold Limit Concentration (STLC).
- c. Where waste is required to be tested for STLC the following shall apply:
 - 1) If the STLC result is less than 5 mg/L (milligrams/liter) the material shall be disposed at a Class II waste landfill. Evidence of such results of the STLC testing will be required by the landfill before waste is accepted. No further testing is required.
 - 2) If the STLC results are 5 mg/L or greater, the waste is a California regulated waste and the material shall be tested using the federally mandated Toxicity Characterization Leaching Procedure (TCLP).
- d. Where waste is required to be tested by TCLP the following shall apply:
 - 1) If the TCLP is less than 5 mg/L, the waste is a California regulated hazardous solid waste (non-RCRA). This material shall be disposed in a Class I hazardous waste landfill.
 - 2) If the TCLP is equal to or greater than 5 mg/L, the waste is a federally regulated hazardous waste solid (RCRA). The waste shall then be disposed in a Class I hazardous waste landfill.
- e. Personal and commercial wash water with lead contamination shall be handled as follows:
 - 1) Filter the waste water through cheesecloth, or other similar filtering media, to remove the gross debris. Separate the waste streams and characterize these in compliance with this Specification.
 - 2) If the waste water is identified as a RCRA or California regulated hazardous waste (Non-RCRA) by STLC and TCLP, filter the waste water by power pumping it through a 20 micron pore size filter. The filtered water shall be tested as described for waste in this Specification.
 - 3) If test results categorize the filtered water as non-hazardous, it may be disposed of in the sewer system.
 - 4) Wastewater, filtered or otherwise, shall not be discharged in storm drains, gutters or allowed to sheet flow over the surface of the ground.

B. Waste Handling:

- 1. Waste, hazardous and non-hazardous, shall be disposed of at an authorized site in accordance with provisions of this Specification and applicable Federal, State, and local laws.

2. Any waste determined to be hazardous, through analytical testing, shall be kept in a secured area or lockable container that is inaccessible to persons other than authorized personnel working on the Project. Hazardous waste containers shall be labeled "Hazardous-Waste – Contains Lead" and labeled with the date waste collection commenced.
3. Hazardous waste shall not remain on the Project site beyond 90 days of the date it was generated. It shall be removed from the Project site and transported to an approved landfill before the 90 days has elapsed.
4. Waste shall not be transported from the work area to the storage container or waste hauler's vehicle while students or staff are present in the path of travel. Where a path of travel cannot be cordoned off the transportation of waste must be completed prior to or after students and staff are not on site.
5. Once hazardous waste is removed from the Project site, ensure it is disposed of in an approved landfill within 6 days. The waste shall not be transported to another site for commingling of waste from a source other than the site of original generation. This requirement shall be documented by the proper execution of a Uniform Hazardous Waste Manifest signed by the landfill operator.
6. Hazardous and non-hazardous waste shall be kept in different containers and stored in separate locations. Commingling of waste is not permitted.
7. As the Work progresses, to prevent exceeding available storage capacity on the Project site, sealed and labeled containers of lead waste shall be removed and transported to the prearranged disposal location.
8. Containers used for hazardous waste shall meet the requirements of EPA and DOT for hazardous waste storage and transport. At a minimum, disposal packaging of Lead Based Paint fragments, dust, and debris shall be in 6-mil polyethylene (plastic) bags that are airtight and puncture resistant.
9. Any debris or residue observed on containers or surfaces outside of the Work Area resulting from clean up or disposal activities shall immediately be cleaned using HEPA filtered vacuum equipment and/or wet methods as appropriate.
10. Materials not contained in bags or other appropriate disposal containers shall not be placed in lead waste storage containers, nor shall storage containers be used for non-lead waste. To avoid damage, packaged waste shall be placed, not thrown, into the storage containers.
11. Lead Contaminated Soil shall be transported in plastic lined containers.

C. Transportation of Non-Hazardous Waste:

1. Receipts from the disposal facility, trip tickets, transportation manifests, weight certificates or other documentation of disposal shall be delivered to the Owner Consultant within 48 hours of disposal. The waste manifest shall be signed by the generator, the transporter(s), and the disposal site operator each time the responsibility for the waste material is transferred. If a separate hauler is employed, the name, address, and signature of the transporter shall also appear on the manifest.

D. Transportation of Hazardous Waste:

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1. Hazardous waste shall be transported by a RCRA/DOT/EPA certified hazardous waste transporter. Provide evidence that the hazardous waste transporter meets the requirements of this Specification.
2. The Work of this section includes responsibility for actions of the hazardous waste transporter as it pertains to waste Removal and disposal related to the Work of this Specification.
3. Identify the facility to which the waste generated by this Specification will be taken. Evidence shall be provided verifying the facility is licensed/permitted to receive and handle non-hazardous lead containing waste and/or hazardous lead containing waste as applicable.
4. Waste disposed as hazardous shall be transported under a Uniform Hazardous Waste Manifest. The generator copy of this manifest shall be submitted to the Owner Consultant within five days of transport.
5. Dump receipts, trip tickets, transportation manifests, weight certificates or other documentation of disposal shall be delivered to the Owner Consultant within 48 hours of disposal. The Uniform Hazardous Waste Manifest shall be signed by the generator (or designee), the transporter(s), and the disposal site operator each time the responsibility for the waste material is transferred. If a separate hauler is employed, the name, address, U.S.E.P.A. ID number and signature of the transporter shall also appear on the manifest.
6. The enclosed cargo area of trucks or containers shall be free of debris and lined with 6-mil polyethylene sheeting to prevent contamination from leaking or spilled containers. Floor sheeting shall be installed first and extend up the walls. Wall sheeting shall be overlapped and taped into place.
7. During transport, drums and other containers shall be placed on level surfaces in the cargo area and packed tightly together to prevent shifting and tipping. Large structural Component shall be secured to prevent shifting and bags placed on top.

3.04 MONITORING

A. Project Management and Inspection:

1. Owner has the right to perform air, wipe, and visual monitoring at any time.
2. Owner shall proceed in accordance with the terms and conditions of the Contract Documents whenever the Work or protective measures are not in compliance with applicable governmental regulations, Contract requirements, and/or threatens the adjoining environment with lead contamination.
3. Where exposure monitoring indicates exposure is at or above the P.E.L. comply with Title 8, CCR Section 1532.1 (e) through (n).

B. Employee – Personal Air Monitoring:

1. Provide air monitoring as required by Title 8 CCR, Section 1532.1. Results shall be provided within ten working days of sampling. If the intent is to utilize such as exposure assessment documentation, and Work is to commence earlier than ten working days, submit results 24 hours in advance of the start of Work.

C. Clearance Inspection:

1. Clearance Inspection for Lead Related Construction Work shall include:
 - a. A visual inspection of the Work Area by the Owner Consultant prior to occupancy for normal activity.
 - b. Do not remove barriers designating a regulated Work Area until a written release from the Owner Consultant is provided.
 - c. The Owner Consultant has the right to collect wipe samples as part of the Clearance Inspection.
2. Clearance Inspection for Abatement shall include:
 - a. A visual inspection of the Work Area by the Owner Consultant prior to collection of environmental samples (dust, wipe, and/or soil samples, as applicable).
 - b. Owner Consultant shall collect environmental samples.
 - c. Results of samples shall comply with Title 17, CCR before the Work Area is released for normal occupancy.
 - d. Where samples fail to meet regulated clearance levels of Title 17, CCR, clean the Work Area as required for final cleaning in the Clean Up Procedures section of this Specification.
 - e. Following cleaning, the visual inspection and environmental sampling will be repeated as described above. This process shall continue until the clearance level of Title 17, CCR is provided.

3.05 RE-ESTABLISHMENT OF THE WORK AREA AND SYSTEMS

- A. Re-establishment of the Work Area shall only occur following the completion of clean-up procedures and after a Clearance Inspection has been performed and documented to the satisfaction of the Owner Consultant.
- B. Re-secure Moveable Objects removed from their former positions during area preparation activities.
- C. Relocate Moveable Objects that were removed to temporary locations back to their original positions.
- D. Reestablish HVAC, mechanical and electrical systems to the condition prior to commencement of the Project.
- E. Repair areas of damage that occurred as a result of Abatement or Lead Related Construction Work.

3.06 PROJECT COMPLETION DOCUMENTATION

- A. Provide to the Owner Consultant of the following close-out documentation:

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1. Filter change logs for air filtration units, water filtration units and respirators
 2. Foreman's daily job reports
 3. Employee entry and exit logs for Work Areas
 4. Visitor entry and exit logs for Work Area
 5. Air sample results for personnel
 6. Copies of hazardous and non-hazardous waste manifest
 7. Hazardous waste weight tickets
 8. Analytical data and chain of custody for waste characterization
 9. Signed Daily Personnel Report Forms
- B. Provide Owner Consultant with as-built drawings identifying surfaces where Lead Based Paint has been encapsulated or enclosed.

END OF SECTION

CIP 689 - Clark Building Renovations

PROJECT NAME
SCHOOL NAME

06/17/2016
LEAD ABATEMENT AND
LEAD RELATED CONSTRUCTION WORK
02 8333-27

SECTION 03 1000 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Formwork for cast-in-place concrete as indicated.
2. Installation of items to be embedded in concrete, such as anchor bolts, inserts, embeds, and sleeves.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 03 2000: Concrete Reinforcing.
3. Section 03 3000: Cast-In-Place Concrete.

1.02 REFERENCES

A. American Concrete Institute (ACI) Publication:

1. ACI 318 – Building Code Requirements for Structural Concrete, Chapter 6, Formwork, Embedded Pipes, and Construction Joints.
2. ACI 347 – Guide to Formwork for Concrete.

B. American Plywood Association (APA):

1. Form No. V345 - Concrete Forming Design/Construction Guide.

C. National Institute of Standards and Technology (NIST):

1. NIST Voluntary Product Standard PS 1.

1.03 SUBMITTALS

- A. Submit detailed structural calculations and drawings approved and signed by a California registered Civil Engineer where the height of the falsework or vertical shoring, as measured from the top of the sills to the soffit of the superstructure exceeds 14 feet, or where individual horizontal span lengths exceed 16 feet, or where provision for vehicular traffic through falsework or shoring occurs. For all other falsework and shoring submit layout signed by California registered Civil Engineer, manufacturer's authorized representative or a licensed contractor experienced in the usage and erection of falsework and vertical shoring. A copy of the plans and calculation shall be available at the jobsite at all times.

- B. Shop Drawings: Submit Shop Drawings indicating locations of forms, construction and expansion joints, embedded items, and accessories.

- C. Product Data: Submit manufacturer's Product Data for form materials and accessories.

1.04 REGULATORY REQUIREMENTS

- A. California Building Code (CBC), Chapter 19A.
- B. California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 4, Construction Safety Orders, Article 6, Excavations, Sections 1713 and 1717.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Storage shall prevent damage and permit access to materials for inspection and identification.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Form materials may be reused during progress of the Work provided they are completely cleaned and reconditioned, recoated for each use, capable of producing formwork of required quality, and are structurally sound.
- B. Form Lumber: WCLIB Construction Grade or Better, WWPA No. 1 or Better.
- C. Plywood: NIST Voluntary Product Standard PS 1, Group 1, Exterior Grade B-B Plyform or better, minimum 5-ply and 3/4 inch thick for exposed locations and at least 5/8 inch thick for unexposed locations, grade marked, not mill oiled. Furnished plywood with medium or high density overlay is permitted.
- D. Coated Form Plywood: For exposed painted concrete, plastic overlaid plywood of grade specified above, factory coated with a form coating and release agent Nox-crete", or equal.
- E. Tube Forms: Sonoco "Seamless Sonotubes," Ceme-Tube, Quik-Tube, or equal, of the type leaving no marks in concrete, one-piece lengths for required heights.
- F. Joist Forms: Code recognized steel or molded plastic types as required.
- G. Special Forms: For exposed integrally-colored concrete, plywood as above with high density overlay, plywood with integral structural hardboard facing or fibrous glass reinforced plastic facing, providing specified finish.
- H. For Exposed Concrete Finish:
 - 1. Plywood: New, waterproof, synthetic resin bonded, exterior type Douglas fir or Southern pine plywood manufactured especially for concrete formwork and conforming to NIST Voluntary Product Standard PS 1, Grade B-B grade, Class I.
 - 2. Glass-Fiber-Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to structural tolerances and appearance of finished concrete surfaces.

- 3. Steel: Minimum 16 gage sheet, well matched, tight fitting, stiffened to support weight of concrete, without deflection detrimental to tolerances and appearances of finished concrete surfaces.
- 4. Plywood: "Finland Form", "Combi Form" by North American Plywood Corporation, "Plyform" by Roy O. Martin, "ProForm" by Pacific Wood Laminates, or equal. The material shall be furnished with hard smooth birch face veneers with phenolic resin thermally fused onto panel sides. Edges shall be factory sealed.
- I. Form Ties: Prefabricated rod, flat band, wire, internally threaded disconnecting type, not leaving metal within 1 1/2-inch of concrete surface.
- J. Form Coating: Non-staining clear coating free from oil, silicone, wax, not grain-raising, "Formshield" by A.C. Horn, Inc., "Release" by Edoco/Dayton Superior, "Cast-Off" by Sonneborn/BASF Building Systems or equal. Where form liners are furnished, provide form coatings recommended by form liner manufacturer.
- K. Form Liner: Rigid or resilient type by L.M. Scofield, Symons, Greenstreak, or equal.
- L. Void Forms: Manufactured by SureVoid Products, Inc., Sonotube, Void Form International, or equal. Forms shall be "WallVoid" for temporary support of concrete walls and grade beams spanning between supports, and "SlabVoid" for creating gaps between concrete slabs or steps and underlying soils. Void forms shall be fabricated of corrugated paper with moisture resistant exterior, and shall be capable of withstanding working load of 1,500 psf. Provide accessories as required.

PART 3 - EXECUTION

3.01 GENERAL

- A. Forms shall be constructed so as to shape final concrete structure conforming to shape, lines and dimensions of members required by Drawings and Specifications, and shall be sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together to maintain position and shape. Forms and their supports shall be designed so that previously placed structures will not be damaged.
- B. Use form coating at all surfaces in contact with concrete.

3.02 TOLERANCES

- A. Permitted abrupt or gradual irregularities in formed surfaces as measured within a 5 feet length with a straightedge shall per ACI 347, Table 3.1:

Class of Surface			
A	B	C	D
1/8 inch	1/4 inch	1/2 inch	1 inch

- 1. Class A: Use for concrete surfaces prominently exposed to public view.

2. Class B: Use for coarse-textured concrete-formed surfaces intended to receive plaster, stucco or wainscoting.
3. Class C: Use as a general standard for permanently exposed surfaces where other finishes are not specified.
4. Class D: Use for surfaces where roughness is not objectionable and will be permanently concealed.

3.03 ERECTION

- A. Plywood shall be installed with horizontal joints level, vertical joints plumb and with joints tight. Back joints by studs or solid blocking, and fill where necessary for smoothness. Reused plywood shall be thoroughly cleaned, damaged edges or surfaces repaired and both sides and edges oiled with colorless form oil. Nail plywood along edges, and to intermediate supports, with common wire nails spaced as necessary to maintain alignment and prevent warping.
- B. Openings for Cleaning: Provide temporary openings at points in formwork to facilitate cleaning and inspection. At base of walls and wide piers, bottom form board on one face for entire length shall be omitted until form has been cleaned and inspected.
- C. Chamfers: Provide 3/4 inch by 3/4 inch chamfer strips for all exposed concrete corners and edges unless otherwise indicated.
- D. Reglets and Rebates: As specified in Section 03 3000: Cast-In-Place Concrete.

3.04 REMOVAL OF FORMS

- A. Forms shall not be removed until concrete has sufficiently hydrated to maintain its integrity and not be damaged by form removal operations. Unless noted otherwise and/or permitted by the Architect, columns and wall forms shall not be removed in less than five days, floor slabs in less than seven days, beams and girders in less than 15 days, pan forms for joists may be removed after three days, but joist centering shall not be removed until after 15 days, and ramp, landing, steps and floor slabs shall not be removed in less than seven days. Shoring shall not be removed until member has acquired sufficient strength to support its weight, load upon it, and added load of construction.
- B. Compressive strength of in-place concrete shall be determined by testing field-cured specimens representative of concrete location or members, as specified in Section 03 3000: Cast-In-Place Concrete.

3.05 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

3.06 CLEAN UP

- A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 03 2000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Concrete steel reinforcement.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 01 4523: Testing and Inspection.
3. Section 03 1000: Concrete Forming.
4. Section 03 3000: Cast-In-Place Concrete.
5. Section 04 2200: Concrete Unit Masonry.

1.02 REGULATORY REQUIREMENTS

- A. Fabrication and placement of reinforcing shall be in accordance with requirements of CBC, Chapter 19A.

1.03 REFERENCES

A. ASTM International:

1. ASTM A184 - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement.
2. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
3. ASTM A706 - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
4. ASTM A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

B. American Concrete Institute (ACI) Publication:

1. ACI SP-66 – ACI Detailing Manual.
2. ACI 318 – Building Code Requirements for Structural Concrete, as modified by CBC.

C. American Welding Society (AWS):

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1. AWS D1.4 – Structural Welding Code – Reinforcing Steel.

1.04 SUBMITTALS

- A. Shop Drawings: Submit steel reinforcement Shop Drawings. Include assembly diagrams, schedule of reinforcement, bending charts and slab and framing plans. Indicate lengths and location of splices, size and lengths of reinforcing steel.
- B. Closeout Submittals: Record exact locations of reinforcing that vary from Contract Documents.

1.05 QUALITY ASSURANCE

- A. Comply with the following as a minimum requirement:
 1. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice.
 2. American Welding Society (AWS).
 3. American Concrete Institute (ACI).
 4. CBC, Chapter 19A, Concrete.
- B. Source Quality Control: Refer to Division 01 Sections for general requirements and to the following paragraphs for specific procedures. Testing laboratory retained by the OWNER shall select test Samples of bars, ties, and stirrups from the material at the Project Site or from the place of distribution, with each Sample consisting of not less than two 18 inch long pieces, and perform the following tests according to ASTM A615, or ASTM A706, as applicable:
 1. Identified Bars: If Samples are obtained from bundles as delivered from the mill, identified as to heat number, accompanied by mill analyses and mill test reports, and properly tagged with the identification certificate so as to be readily identified, perform one tensile and one bend test for each 10 tons or fraction thereof of each size of bars. Submit mill reports when Samples are selected.
 2. Unidentified Bars: When positive identification of reinforcing bars cannot be performed and when random Samples are obtained; perform tests for each 2.5 tons or fraction thereof, one tensile and one bend test from each size of bars.
- C. Certification of Welders: Shop and Project site welding shall be performed by welding operators certified by AWS.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Avoid exposure to dirt, moisture or conditions harmful to reinforcing.
- B. Reinforcing steel bars, wire, and wire fabric shall be stored on the Project site to permit easy access for examination and identification of each shipment. Material of each shipment shall be separated for size and shape.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Provide reinforcing of sizes, gages and lengths indicated, bent to indicated shapes.

2.02 MATERIALS

- A. Steel Reinforcing Bars:
 - 1. ASTM A615, deformed grade 60 or 75 billet steel, as indicated on the drawings.
 - 2. Weldable reinforcing bars shall conform to ASTM A706.
- B. Bars or Rod Mats: ASTM A184.
- C. Welded Wire Fabric for Reinforcement: ASTM A1064.
- D. Tie Wire: ASTM A1064, fully annealed, copper-bearing steel wire, 16 gage minimum.
- E. Chairs, Spacers, Supports, and Other Accessories: Standard manufacture conforming to ACI 315 fabricated from steel wire of required types and sizes. For reinforcement supported from grade, provide properly sized dense precast blocks of concrete.

2.03 FABRICATION OF REINFORCING BARS

- A. Comply with CRSI Manual of Standard Practice for Reinforced Concrete Construction for fabrication of reinforcing steel.
- B. Bending and Forming: Fabricate bars of the indicated sizes and bend and form to required shapes and lengths by methods not injurious to materials. Do not heat reinforcement for bending. Bend bars No. 6 size and larger in the shop only. Bars with unscheduled kinks or bends are not permitted. Provide only tested and permitted bar materials.
- C. Welding: Provide only ASTM A706 steel where welding is indicated. Perform welding by the direct electric arc process in accordance with AWS D1.4 and specified low-hydrogen electrodes. Preheat 6 inches each side of joint. Protect joints from drafts during the cooling process; accelerated cooling is not permitted. Do not tack weld bars. Clean metal surfaces to be welded of loose scale and foreign material. Clean welds each time electrode is changed and chip burned edges before placing welds. When wire brushed, the completed welds must exhibit uniform section, smooth welded metal, feather edges without undercuts or overlays, freedom from porosity and clinkers, and good fusion and penetration into the base metal. Cut out welds or parts of welds deemed defective, using chisel, and replace with proper welding. Prequalification of welds shall be in accordance with CBC requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Bars shall be bent cold. Bars partially embedded in concrete shall not be field bent except as indicated on reviewed Shop Drawings.
- B. Before installation and just prior to placing concrete, clean reinforcing of loose scale, rust, oil, dirt and any coating that could reduce bond.

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- C. Accurately position, install, and secure reinforcing to prevent displacement during the placement of concrete.
- D. Provide metal chairs to hold reinforcement the required distance above form bottoms. In beams and slab construction, provide chairs under top slab reinforcement as well as under bottom reinforcement. Space chairs so that reinforcement will not be displaced during installation. Provide metal spacers to secure proper spacing. Stirrups shall be accurately and securely wired to bars at both top and bottom. At slabs, footings, and beams in contact with earth, provide concrete blocks to support reinforcement at required distance above grade.
- E. Install and secure reinforcement to maintain required clearance between parallel bars and between bars and forms. Lapped splices shall be installed wherever possible in a manner to provide required clearance between sets of bars. Stagger lapped splices. Dowels and bars extending through construction joints shall be secured in position against displacement before concrete is installed and subsequently cleaned of concrete encrustations while they are still soft.
- F. Do not install reinforcing in supported slabs and beams until walls and columns have been installed to underside of slabs and beams or until construction joints have been thoroughly cleaned. Reinforcing shall be inspected before placement of concrete and cleaned as required.
- G. Use deformed bars unless otherwise indicated, except for spiral reinforcement.

3.02 CLEAN UP

- A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.03 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Cast-in-place normal weight and lightweight concrete, placement and finishing.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 03 1000: Concrete Forming and Accessories.
3. Section 03 2000: Concrete Reinforcing.
4. Section 32 1313: Site Concrete Work.

1.02 REFERENCES

A. American Concrete Institute (ACI) Publication:

1. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 – Specifications for Structural Concrete.
3. ACI 302.1R – Guide for Concrete Floor and Slab Construction.
4. ACI 305R - Specification for Hot Weather Concreting.
5. ACI 306.1 – Standard Specification for Cold Weather Concreting.
6. ACI 308R – Guide to External Curing of Concrete.
7. ACI 318 - Building Code Requirements for Structural Concrete, as modified by CBC Sections 1903A and 1905A.

B. American Society for Testing and Materials (ASTM) Standards:

1. ASTM C31 – Standard Specification for Making and Curing Concrete Test Specimens in the Field.
2. ASTM C33 - Standard Specification for Concrete Aggregates.
3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
4. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

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5. ASTM C88 - Standard Test Method for Soundness of Aggregates by use of Sodium Sulphate or Magnesium Sulphate.
6. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
7. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
8. ASTM C150 - Standard Specification for Portland Cement.
9. ASTM C156 – Standard Test Method for Water Loss (from a Mortar Specimen) Through Liquid Membrane-Forming Curing Compounds for Concrete.
10. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
11. ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete.
12. ASTM C173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
13. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.
14. ASTM C289 - Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
15. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
16. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
17. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
18. ASTM C567 - Standard Test Method for Determining Density of Structural Lightweight Concrete.
19. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
20. ASTM C845 - Standard Specification for Expansive Hydraulic Cement
21. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
22. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
23. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
24. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
25. ASTM C1315 – Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

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26. ASTM D1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
27. ASTM C1567 - Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method).
28. ASTM D1751 - Standard Test Method for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
29. ASTM D7234 – Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
30. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
31. ASTM E1155 - Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers.
32. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
33. ASTM E1745 - Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
34. ASTM F710 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
35. ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
36. ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes.
37. ASTM F3010 – Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use under Resilient Floor Coverings.

1.03 SUBMITTALS

- A. Shop Drawings: Submit Shop Drawings indicating locations of cast-in-place concrete Work and accessory items such as vapor barriers. Include details and locations of reinforcing, embedded items, and interfacing with other Work.
- B. Mix Design Data: Submit concrete mix designs as specified herein and in Article 2.02.
 1. Submit name, address and telephone number of the concrete production facility which the contractor intends to engage to design the concrete mixes. Submit name and qualifications of the proposed concrete technologist.
 2. Mix Design: Submit a concrete mix design for each strength and type of concrete indicated in the drawings or specified. Include water/cement ratio, source, size and amount of coarse aggregate and admixtures. Predict minimum compressive strength,

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maximum slump and air content percentage. Clearly indicate locations where each mix design will be used.

- a. Water/cement ration for concrete slabs on grade shall be 0.50 maximum.
3. Test Reports: Submit copies of test reports showing that the proposed mixes produce concrete with the strengths and properties specified. Include tests for cement, aggregates and admixtures. Provide gradation analysis.
- C. Material Samples: Submit Samples illustrating concrete finishes and hardeners, minimum 12-inch by 12-inch.
- D. Certificates: Submit certification that each of the following conforms to the standards indicated:
 1. Portland cement: ASTM C150.
 2. Normal weight concrete aggregates: ASTM C33.
 3. Lightweight concrete aggregates: ASTM C330.
 4. Aggregates: Submit evidence that the aggregate is not reactive in the presence of cement alkalis. In the absence of evidence, aggregate shall be tested by one of the methods in ASTM C33 Appendix XI, Methods for Evaluating Potential for Deleterious Expansion Due to Alkali Reactivity of an Aggregate. Aggregates deemed to be deleterious or potentially deleterious may be used with the addition of a material that has been shown to prevent harmful expansion in accordance with Appendix XI of ASTM C33, when approved by the building official, in accordance to CBC Section 1903A5A.
 5. Curing materials: ASTM C171.
- E. Admixtures: Submit product data for proposed concrete admixtures.

1.04 QUALITY ASSURANCE

- A. Continuous inspection shall be provided at the batch plant and for transit-mixed concrete to run check sieve analysis of aggregate, check moisture content of fine aggregate, check design of mix, check cement being used with test reports, check loading of mixer trucks, and certify to quantities of materials placed in each mixer truck.
- B. Inspection shall be performed by a representative of a testing laboratory selected by the OWNER. OWNER will pay for inspection costs. Notify the laboratory 24 hours in advance of time concrete is to be mixed. Notify the laboratory of postponement or cancellation of mixing within at least 24 hours of scheduling time.
- C. CONTRACTOR shall assist the testing laboratory in obtaining and handling samples at the project site and at the source of materials.
- D. Continuous batch plant inspection requirement may be waived in accordance with CBC Section 1705A.3.3.1. Waiver shall be in writing, including DSA approval. When batch plant inspection is waived by DSA, the following requirements shall be met:
 1. Approved inspector of the testing laboratory shall check the first batching at the start of work and furnish mix proportions to the licensed weightmaster.

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2. Licensed weightmaster shall positively identify materials as to quantity and certify to each load by a ticket.
 3. Tickets shall be transmitted to the Inspector by a truck driver with load identified thereon. The Inspector will not accept the load without a load ticket identifying the mix and will keep a daily record of placements, identifying each truck, its load and time of receipt and approximate location of deposit in the structure and will transmit a copy of the daily record to DSA.
 4. At the end of the project, the weightmaster shall furnish an affidavit to DSA certifying that all concrete furnished conforms in every particular to proportions established by mix designs.
- E. Special Inspections and Tests shall be in accordance with CBC Chapter 17A, Reinforcement and Anchor testing per CBC Section 1910A and Specification Section 01 4523.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Store cement and aggregate materials so as to prevent their deterioration or intrusion by foreign matter. Deteriorated or contaminated materials shall not be furnished.
- B. Packaged materials shall bear the manufacturers and brand name label and shall be stored in their original unbroken package in a weather tight place until ready for use in the work.

1.06 PROJECT CONDITIONS

- A. Cold Weather Requirements: Batching, mixing, delivering and placing of concrete in cold weather shall comply with the applicable requirements of ACI 306.1.
- B. Hot Weather Requirements: Batching, mixing, delivering and placing of concrete in hot weather shall comply with the applicable requirements of ACI 305R.
- C. Concrete temperature of freshly mixed concrete shall be determined per ASTM C1064.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cement: ASTM C150. Portland Cement.
- B. Aggregates: Conform to the following standards:
 1. Normal weight concrete: ASTM C33.
 2. Lightweight concrete: ASTM C330, with fine aggregates per ASTM C33.
 3. Aggregate shall be tested for Potential Alkali Reactivity of Cement-Aggregate Combinations per ASTM C289.
 4. Nominal maximum size of coarse aggregate shall be no larger than:
 - a. 1/5 the narrowest dimension between sides of forms, nor

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- b. 1/3 the depth of slabs, nor
 - c. 3/4 the clear spacing between individual reinforcing bars or wires, bundles of bars, individual tendons, or ducts.
- C. Water: Water for concrete mixes, curing and cleaning shall be potable and free from deleterious matter.
- D. Admixtures: Shall be shown capable of maintaining essentially the same composition and performance throughout the work as the product used in establishing concrete proportions in accordance with ACI 318, Section 3.6.
 - 1. Admixtures containing chlorides or sulfides are not permitted.
 - 2. Air-entraining admixtures shall comply with ASTM C260. Air-entrained admixtures shall not be used for floor slabs to receive steel trowel finish.
 - 3. Admixtures for water reduction and setting time modification shall conform to ASTM C494.
 - 4. Admixtures for producing flowing concrete shall conform to ASTM C1017.
 - 5. Fly ash, pozzolan and ground granulated blast-furnace slag: Modify ACI 318 Sections 3.6.6 and 3.6.7 as follows:
 - a. Fly ash or other pozzolan used as a partial substitution for ASTM C150 Portland cement shall meet the following requirements:
 - 1) Shall conform to ASTM C618 for Class N or F materials (Class C is not permitted).
 - b. Ground-granulated blast-furnace slag used as a partial substitution for ASTM C150 Portland cement shall meet the following requirements:
 - 1) Shall conform to ASTM C989.
 - 6. Admixtures containing ASTM C845 expansive cements shall be compatible with the cement and produce no deleterious effects.
 - 7. Silica fumes used as an admixture shall conform to ASTM C1240.
- E. Reinforcement Fibers: Chop strands of alkali-resistant polypropylene or nylon fibers added to the concrete mix for protection against shrinkage cracks.
- F. Expansion Joint Fillers: Preformed strips, non-extruding and resilient bituminous type, of thickness indicated, conforming to ASTM D1751.
- G. Curing:
 - 1. Curing Paper: Shall conform to ASTM C171 and consist of two sheets of kraft paper cemented together with a bituminous material in which are embedded cords or strands of fiber running in both directions. The paper shall be light in color, shall be free of visible defects, with uniform appearance.

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2. Elevated slabs and slabs on grade may be cured at CONTRACTOR's option with curing and proactive water vapor emission and alkalinity control system. Products shall be approved by OWNER's Office of Environmental Health and Safety.
 - a. VaporSeal 309, by Floor Seal Technology, Inc., or equal.
 - 1) ASTM C156: 0.39 kg/m².
 - 2) ASTM C309: Exceeds requirements.
 - 3) ASTM C1315: Exceeds requirements.
 - 4) ACI 308R-01 Compliant.
 - b. Remedial Treatment: Water vapor emission and alkalinity control treatment, MES 100 by Floor Seal Technology, Inc. or equal.
 - 1) ASTM E96: <0.1 Perms.
 - 2) ASTM D1308: 14pH Resistant.
 - 3) ASTM D7234: 500+psi 100% concrete failure.
 - 4) ASTM F2170: 100%RH resistant.
 - 5) VOC Content: <100 g/L, meets SCAQMD Rule #1113.
 - 6) ASTM F3010: Meets Requirements.
 - c. Self-leveling Compounds: Ardex Engineered Cements, K15, or V1200, Schonox ZM Rapid, US Self Leveler Armstrong, S-194, or equal.
- H. Floor Hardener: Water soluble, inorganic, silicate-based curing, hardening, sealing and dustproofing compound. Aquaseal W20 by Monopole Inc., Kure-N-Harden by BASF, Chem Hard by L&M, Liqui-Hard by W. R. Meadows, or equal.
- I. Underlayment: Two component latex underlayment for filling low spots in concrete for both interior and exterior applications, from featheredge to a maximum of 3/8 inch in thickness. Underlayment shall be non-shrink and suitable for repairing exposed concrete surfaces and for underlayment of carpet, resilient, tile and quarry floor coverings. La-O-Tex by TexRite, Underlay C, RS by Mer-Krete Systems, Underlayment 962 by C-Cure, or equal.
- J. Vapor Barrier: Treads and Nosings: Two part stair tread and nosing with ribbed abrasive bars. Fabricated from 6063-T5 or 6063-T6 extruded aluminum, mill finish. Anti-slip abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Color shall extend uniformly throughout filler.
 1. American Safety Tread: TP-311R.
 2. Balco Inc.: DST-330.
 3. Nystrom: STTB-P3.375E.
 4. Wooster Products Inc.: WP-RN3SG.

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5. Equal.

- K. Grout: ASTM C1107, non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 7 days; of consistency suitable for application and a 30 minute working time.

2.02 CONCRETE MIX

- A. Mix shall be signed and sealed by a Civil or Structural Engineer currently registered in the State of California.
- B. Strength of Concrete: Strengths and types of concretes shall be as indicated in the Drawings. Unless otherwise indicated or specified, concrete shall be provided with minimum 28-day strength of 3000 psi (f'c).
- C. Concrete mix shall meet the durability requirements of ACI 318, Chapter 4.
- D. Concrete proportioning shall be determined on the basis of field experience and/or trial mixtures shall in accordance with ACI 318, Section 5.3. Proportions of materials shall provide workability and consistency to permit concrete to be placed readily into forms and around reinforcement under conditions of placement to be employed, without segregation or excessive bleeding.
- E. Ready-Mixed Concrete: Mix and deliver in accordance with requirements of ASTM C94.

PART 3 - EXECUTION

3.01 GENERAL

- A. Surfaces to receive concrete shall be free of debris, standing water, and any other deleterious substances before start of concrete placing.
- B. Time of Placing: Do not place concrete until reinforcement, conduits, outlet boxes, anchors, hangers, sleeves, bolts, and other embedded materials are securely fastened in place. Contact the Inspector at least 24 hours before placing concrete; do not place concrete until inspected by the Project Inspector.
- C. Pouring Record: A record shall be kept on the Project site of time and date of placing concrete in each portion of structure. Such record shall be maintained on the Project site until Substantial Completion and shall be available for examination by the ARCHITECT and DSA.

3.02 TOLERANCES

- A. Concrete construction tolerances shall be as specified in ACI 117 and as modified herein.
- B. Floor Flatness (F_F) and Floor Levelness (F_L) shall be as indicated below:

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	Specified Overall Value		Minimum Local Value	
	F _F	F _L	F _F	F _L
Slabs on ground: mechanical and electrical rooms, parking structures and mortar bed set tile and quarry flooring.	20	15	15	10
Slab on ground: carpet.	25	20	17	15
Slab on ground: thinset tile and resilient flooring.	35	25	24	17
Suspended slabs: mechanical and electrical rooms, parking structures and mortar bed set tile and quarry flooring.	20	15	N/A	N/A
Suspended slabs: carpet.	25	20	N/A	N/A
Suspended slabs: thinset tile and resilient flooring.	35	20	N/A	N/A

- C. Refer to ACI 302.1R, Tables 8.1 and 8.2 Slab on Ground and Suspended Flatness/Levelness Construction Guide, for recommended concrete placing and finishing methods.
- D. Floor Flatness and Floor Levelness shall be tested in accordance to ASTM E1155. Floor measurements shall be made within 48 hours after slab installation, and shall precede removal of shores and forms.

3.03 PREPARATION

- A. Reglets and Rebates:
 1. Form reglets and rebates in concrete to receive flashing, frames and other equipment as detailed and required. Coordinate dimensions and locations required with other related Work.
 2. If concrete slabs on grade adjoin a wall or other perpendicular concrete surface, form a reglet in wall to receive and carry horizontal concrete Work. Reglet shall be full thickness of the slab and shall be 3/4 inch wide, unless otherwise indicated. Requirement does not apply to exterior walks, unless specifically indicated.
- B. Screeds: Install screeds accurately and maintain at required grade or slab elevations after steel reinforcement has been installed, but before starting to place concrete. Install screeds adjacent to walls and in parallel rows not to exceed 8 feet on centers.

3.04 INSTALLATION

- A. Conveying and Placing:
 1. Concrete shall be placed only under direct observation of the Project Inspector. Do not place concrete outside of regular working hours, unless the Inspector has been notified at least 48 hours in advance.

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2. Concrete shall be conveyed from mixer to location of final placement by methods that will prevent separation or loss of materials.
3. Concrete shall be placed as nearly as practicable to its final position to avoid segregation due to re-handling or flowing. No concrete that has partially hydrated or has been contaminated by foreign materials shall be placed, nor shall re-tempered concrete or concrete which has been remixed after initial set be placed.
4. In placing concrete in columns, walls or thin sections, provide openings in forms, elephant trunks, tremies or other recognized devices, to prevent segregation and accumulation of partially hydrated concrete on forms or metal reinforcement above level of concrete being placed. Such devices shall be installed so that concrete will be dropped vertically. Unconfined vertical drop of concrete from end of such devices to final placement surface shall not exceed 6 feet.
5. Concrete shall be placed as a continuous operation until placing of panel or section is completed. Top surfaces of vertically formed lifts shall be level.
6. Concrete shall be thoroughly consolidated by suitable means during placement and shall be thoroughly worked around reinforcement and embedded fixtures and into corners of forms.
7. Where conditions make consolidation difficult or where reinforcement is congested, batches of mortar containing same proportions of cement, sand, and water as provided in the concrete, shall first be deposited in the forms to a depth of at least one inch.

B. Cold Weather:

1. Provide adequate equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather. All ground with which concrete is to come in contact shall be free from frost. No frozen materials or materials containing ice shall be used.
2. The temperature of concrete at the time of placement shall not be below the minimum temperatures given in Table 3.1 of ACI 306.1.
3. Concrete shall be maintained at a temperature of at least 50° F. for not less than 72 hours after placing or until it has thoroughly hardened. Cover concrete and provide sufficient heat as required. When necessary, aggregates shall be heated before mixing. Special precautions shall be taken for protection of transit-mixed concrete.

C. Hot Weather:

1. Concrete to be placed during hot weather shall comply with the requirements of ACI 318, Section 5.13.
2. Maintain concrete temperatures indicated in Table 2.1.5 of ACI 305R to prevent the evaporation rate from exceeding 0.2 pound of water per square feet of exposed concrete per hour.
3. Cool concrete using methods indicated in ACI 305R Appendix B.
4. Place and cure concrete as specified in ACI 305R Chapter 4.

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D. Compaction and Screeding:

1. Tamp freshly placed concrete with a heavy tamper until at least 3/8 inch of mortar is brought to surface. Concrete shall then be tamped with a light tamper and screeded with a heavy straightedge until depressions and irregularities are eliminated, and surface is true to finish grades or elevations. Remove excess water and debris.
2. Where slabs are to receive separate cement finish or mortar setting bed, continued tamping to raise mortar to surface is not performed. Laitance shall be removed by brushing with a stiff brush or by light sandblasting to expose clean top surface of coarse aggregate.

E. Floating and Troweling:

1. When concrete has hydrated sufficiently, it shall be floated to a compact and smooth surface. After floating, wait until concrete has reached proper consistency before troweling. Top surfaces shall receive at least 2 troweling operations with steel hand trowel. Prior to and during final troweling, apply a fine mist of water frequently with an atomizing type fog sprayer. Omit troweling for slabs to receive a separate cement finish.
2. For interior finish slabs, final troweling shall provide a hard, impervious, and non-slip surfaces, free from defects and blemishes. Finished surface shall be within tolerances indicated in Article 3.02. Avoid burnishing. Do not add cement or sand to absorb excess moisture.
 - a. Floor of Walk-In Refrigerator: Finish as specified above, to a smooth finish.
 - b. Floor of Gymnasium Locker Rooms: After floating, and while the surface is still plastic, provide a fine textured finish by drawing a fine fiber bristle broom uniformly over the surface in one direction only. Floors sloped for drainage should be brushed in the direction of flow.
3. Vertical concrete surfaces shall be finished smooth and free from marks or other surface defects.

3.05 CURING

- A. Length of time, temperature and moisture conditions for curing concrete shall be in accordance with ACI 318, Section 5.11.
- B. Forms containing concrete, top of concrete between forms, and exposed concrete surfaces after removal of forms shall be maintained in a thoroughly wet condition for at least 7 consecutive days after placing.
- C. If weather is hot or surface has dried out, spray surface of concrete slabs and paving with fine mist of water, starting not later than 2 hours after final troweling and continuing until sunset. Surface of finish shall be kept continuously wet until curing medium has been installed.
- D. Immediately after finishing, monolithic floor slabs shall be covered with curing paper. Paper shall be lapped 4 inches at joints and sealed with waterproof sealer. Edges shall be cemented to finish. Repair or replace paper damaged during construction operations.
- E. When curing slabs with proactive water vapor emission and alkalinity control system:

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1. Coordinate and schedule application of curing compound with concrete pour schedule, while conforming to manufacturer's application instructions.
2. When the surface of the concrete has hardened sufficiently to sustain foot traffic pre-cure slabs with liquefied product application following manufacturer's written instructions. Application shall be by trained applicators.
3. Monitor Environmental Conditions: Set up weather station 20 to 30 inches above freshly placed concrete. Record temperature, humidity and wind velocity measurements at 15 minute maximum intervals.
4. Calculate Evaporation Rate: Use recorded weather information in combination with nomograph per ACI 308R, Figure 4.1, Guide to Curing Concrete, to evaluate relevant evaporation rate.
5. When the bleed water rate of the concrete is approximately equal to the surface water evaporation rate, spray curing compound material throughout surface of slabs and decks, following manufacturer's written instructions. Application shall be by trained applicators.
6. Perform the following tests at least 28 days after placement of concrete and prior to floor covering installation. Submit to OAR test results indicating locations that do not comply with scheduled flooring installation requirements.
 - a. Calcium chloride testing per ASTM F1869.
 - b. Relative humidity testing per ASTM F2170.
 - c. Alkalinity testing per ASTM F710.
 - d. Perform concrete bond layer humidity meter testing to determine substrate surface acceptability.
7. Areas emitting moisture and alkalinity at rates exceeding floor covering manufacturer's published ASTM F1869 limits, shall receive a corrective coating, at no cost to the OWNER, as follows:
 - a) Mask and protect adjacent walls and floor surfaces from effects of scarification and application of remedial treatment.
 - b) Scarify slab surface in area of application by shot blasting or other method acceptable to corrective coating manufacturer.
 - c) Prepare and fill cracks, control joints and cold joints.
 - d) Apply two-component modified epoxy penetrant and coating with roller and squeegee over required treatment area; saturate surfaces to ensure a through mechanical bond.
 - e) Clean and fill divots, chips, voids and other surface irregularities with one hundred percent Portland cement based patching compound or cementitious fill.
 - f) Apply cementitious surfacing over coating in areas to receive resilient and wood floor coverings to facilitate adhesion; apply to a thickness of 1/8 inch.

3.06 FILLING, LEVELING AND PATCHING

- A. Concrete slabs exhibiting high or low spots and indicated to receive resilient floor covering or soft floor covering, shall have surfaces repaired. High spots shall be honed, or ground with power-driven machines to required tolerances. Low spots shall be filled with latex underlayment, installed in strict accordance with manufacturer's written recommendations.
- B. Holes resulting from form ties or sleeve nuts shall be solidly packed, through exterior walls, by pressure grouting with cement grout, as specified. Grouted holes on exposed surfaces shall be screeded flush and finished to match adjoining surfaces.
- C. Cement Base: Cement base shall be of the height, thickness, and shape detailed. Base shall be reinforced with one inch mesh, 18 gage, zinc-coated wire fabric. Base finish mixture shall be one part Portland cement, 2 parts of fine aggregate and one part pea gravel. Colored cement base shall include a chemically inert mineral oxide pigment in the mix.

3.07 FINISHING

- A. Soda and Acid Wash: Concrete surfaces to receive plaster, paint or other finish, and which have been formed by oil coated forms, shall be scrubbed with a solution of 1-1/2 pounds of caustic soda to one gallon of water. Surfaces where smooth wood or waste molds have been furnished shall be scrubbed with a solution of 20 percent muriatic acid. Wash with clean water after scrubbing.
- B. Sacking: Exposed concrete curbs, walls, and other surfaces shall be sacked by an application of Portland cement grout, floated, and rubbed. Sacking shall not be performed until patching and filling of holes has been completed. Entire sacking operation for any continuous area shall be started and completed within the same day.
 - 1. Mix one part Portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having consistency of thick paint. Wet surface of concrete sufficiently to prevent absorption of water from grout. Apply grout uniformly with a brush or spray gun, then immediately float surface with a cork or other suitable float, scouring wall vigorously.
 - 2. While grout is still plastic, finish surface with a sponge-rubber float, removing excess grout. Allow surface to dry thoroughly, then rub vigorously with dry burlap to completely remove dried grout. No visible film or grout shall remain after rubbing with burlap.
- C. Sandblasting: Exterior concrete surfaces to receive stucco dash coat finish, where plywood or other smooth forms have been furnished, shall be uniformly sand-blasted with sharp quartz sand under sufficient air pressure to remove dirt, form oil and other foreign materials, and roughen surface to provide a proper bond. Such surfaces shall be thoroughly washed with clean water after sandblasting.
- D. Abrasive: Concrete stair treads, landings, ramps and steps on interior and exterior of buildings, and interior exposed concrete floors in shop buildings shall receive an abrasive finish.
- E. Floor Hardener: Exposed interior concrete floors throughout shall be treated with floor hardener.
 - 1. Protect adjacent surfaces. Clean surfaces to receive treatment in accordance with manufacturer's instructions, ensuring that all stains, oil, grease, form release agents, laitance, dust and dirt are removed prior to application.

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2. Apply hardener in accordance with manufacturer's instructions as soon as concrete is firm enough to work on after final troweling.
- F. Cement Grout and Dry-Pack Concrete: Cement grout shall be mixed at the Project site and shall be composed of one volume of Portland cement and 2-1/2 volumes of fine aggregate. Materials shall be mixed dry with sufficient water added to make mixture flow under its own weight. When grout is used as a dry pack concrete, add sufficient water to provide a stiff mixture, which can be molded into a sphere.
- G. Broom Finish: Exterior stair treads and landings shall be provided with a non-slip broom finish in addition to abrasive finish specified.
- H. Abrasive Stair Nosing: Nosing shall be installed according to manufacturers written recommendations.

3.08 EXPANSION AND CONSTRUCTION JOINTS

- A. Construction Joints: Details and proposed location of construction joints shall be as indicated on the Drawings, located to least impair strength of structure, in accordance with the following:
1. Thoroughly clean contact surface by sand blasting entire surface not earlier than 5 days after initial placement.
 2. A mix containing same proportion of sand and cement provided in concrete plus a maximum of 50 percent of coarse aggregate shall be placed to a depth of at least one inch on horizontal joints. Vertical joints shall be wetted and coated with a neat cement grout immediately before placing of new concrete.
 3. Should contact surface become coated with earth, sawdust, or deleterious material of any kind after being cleaned, entire surface shall be re-cleaned before applying mix.
- B. Expansion Joints: Provide expansion joints where indicated in walks and exterior slabs. Space approximately 20 feet apart, unless otherwise indicated. Joints shall extend entirely through slab with joint filler in one piece for width of walk or slab. Joint filler shall be 3/8 inch thick, unless otherwise indicated.
- C. Tooled Joints: Slabs, walks and paving shall be marked into areas as indicated with markings made with a V-grooving tool. Marks shall be round-edged, free from burrs or obstructions, with clean cut angles and shall be straight and true. Walks, if not indicated, shall be marked off into rectangles of not more than 12 square feet and shall have a center marking where more than 5 feet wide.

3.09 TESTING

- A. Molded Cylinder Tests:
1. Inspector or testing lab personnel will prepare cylinders and perform slump tests. Samples for concrete strength shall be taken in accordance to ASTM C172. Each cylinder shall be dated, given a number, point in structure from which sample was obtained, mix design number, mix design strength and result of accompanying slump test noted.

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2. Separate tests of molded concrete cylinders obtained at same place and time shall be made at age of three days, seven days, and 28 days. A strength test shall be the average of the compressive strength of two cylinders, obtained from the same sample of concrete and tested at 28 days or at test age designated for determination of f_c .
 3. Test cylinders shall be prepared at the Project site and stored in testing laboratory in accordance with ASTM C31, and tested in accordance with ASTM C39.
- B. Core Test: At request of the ARCHITECT, cores of hardened concrete shall be cut from portions of hydrated structures for testing, in accordance with CBC and ASTM C42.
1. Provide 4 inch diameter cores at representative places throughout the structure as designated by the ARCHITECT.
 2. In general, provide sufficient cores to represent concrete placed with at least one core for each 4,000 square feet of building area, and at least 3 cores total for each Project.
 3. Where cores have been removed, fill voids with drypack, and patch the finish to match the adjacent existing surfaces.
- C. Concrete Consistency: Measure consistency according to ASTM C143. Test twice each day or partial day's run of the mixer.
- D. Adjustment of Mix: If the strength of any grade of concrete for any portion of Work, as indicated by molded test cylinders, falls below minimum 28 days compressive strength specified or indicated, adjust mix design for remaining portion of construction so that resulting concrete meets minimum strength requirements.
- E. Air Content Testing: Measure in accordance to ASTM C173 or ASTM C231, for each composite sample taken in accordance to ASTM C172.
- F. Defective Concrete:
1. Should strength of any grade of concrete, for any portion of Work indicated by tests of molded cylinders and core tests, fall below minimum 28 days strength specified or indicated, concrete will be deemed defective Work and shall be replaced or adequately strengthened in a manner acceptable to the ARCHITECT and DSA.
 2. Concrete Work that is not formed as indicated, is not true within 1/250 of span, not true to intended alignment, not plumb or level where so intended, not true to intended grades and levels, contains sawdust shavings, wood or embedded debris, or does not fully conform to Contract provisions, shall be deemed to be defective Work and shall be removed and replaced.
- G. Concrete for Equipment Pads, Mechanical and Electrical Work: Unless otherwise indicated, strength shall have a minimum $f_c = 3,000$ psi. Exposed concrete shall be provided with a hand trowel finish with radius corners and edges. Form and place concrete where necessary as described in Section 03 1000 Concrete Forming and Accessories, and reinforced as described in Section 03 2000 Concrete Reinforcing. Calcium chloride shall not be furnished in any concrete mix provided for the installation of underground electrical conduits. For concrete encasement of more than one conduit, furnish 3/4 inch maximum aggregate.

3.10 CLEAN UP

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- A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.11 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

END OF SECTION

055000 – METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Steel framing and supports for countertops.
 - 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 3. Miscellaneous framing supports.
 - 4. Miscellaneous steel trim.
 - 5. Abrasive metal nosings.
 - 6. Trash enclosure gates.

1.3 DEFINITIONS

- A. Exterior: Defined as the following:
 - 1. Areas, locations, and surfaces that are unprotected, or exposed to environmental elements.
 - 2. Areas, locations and surfaces within uncontrolled environments.
 - 3. Areas, locations and surfaces of unconditioned spaces, including below grade/underground, partially-exposed, or “covered” parking areas.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
- B. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.5 SUBMITTALS

- A. Product Data: For items specified.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."

1.7 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal fabrications that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 1 year.
- B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Extruded Abrasive Metal Nosings: Subject to compliance with requirements, provide either the product by named manufacturer or an equal product by one of the other manufacturers specified.
 - 1. Type 24 by American Safety Tread Co., Inc. (Basis of Design)
 - 2. Type 24 Spectra by Wooster Products Inc.
 - 3. Or equal.

2.2 METALS, GENERAL

- 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.

2.3 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36.
- B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.

- C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- D. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- E. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

2.4 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, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Anchor Bolts: ASTM F 1554, Grade 36.
 - 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
- F. 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.

2.6 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 true to line and level 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 where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, 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.
 - 1. 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.

2.7 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 retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Galvanize miscellaneous framing and supports where indicated.
- E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.8 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 not less than two integrally welded steel strap anchors for embedding in concrete.

2.9 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.
- C. Galvanize exterior miscellaneous steel trim and interior miscellaneous steel trim, where indicated.

2.10 ABRASIVE METAL NOSINGS

- A. Extruded Units: Aluminum, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.
 - 1. Provide anti-slip strip of contrasting color 2 inches wide, parallel to and not more than 1 inch from the front nose of each step.
- B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- C. Drill for mechanical anchors and countersink. Locate not more than 4 inches from ends and not more than 12 inches o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.
 - 1. Provide 2 rows of holes for units more than 5 inches wide, with 2 holes aligned at ends and intermediate holes staggered.
- D. Apply bituminous paint to concealed bottoms, sides, and edges of cast-metal units set into concrete.
- E. Apply clear lacquer to concealed bottoms, sides, and edges of extruded units set into concrete.

2.11 TRASH ENCLOSURE GATES

- A. Gate Configuration, Frame Height, and Opening Width: As indicated on Drawings.
- B. Framing: Fabricated steel tubes, angles, and plates as detailed on Drawings, hot-dipped galvanized finish after fabrication, with galvanized corrugated steel panel infill.
- C. Gate Hardware:

1. As indicated on Drawings, welded-on heavy weight butt hinges, minimum 3-hinges per gate leaf, hot-dipped galvanized finish.
 2. Cane Bolts: Provide for inactive leaf of pairs of gates. Fabricated from 3/4-inch- diameter, round steel bars, hot-dip galvanized after fabrication. Finish to match gates. Provide galvanized-steel pipe strikes to receive cane bolts in both open and closed positions.
- D. Finish: Field finish per Division 9 Section "Painting".
1. Color: As indicated on Drawings.

2.12 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.

2.13 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 1. ASTM A 123, for galvanizing steel and iron products.
 2. ASTM A 153, for galvanizing steel and iron hardware.
- B. 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 metal fabrications:
 1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, 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.
 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
- D. Field Finish: Comply with Division 9 Section "Painting" for field 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 rack; 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 bolts, 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.

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 securely to and rigidly brace from building structure.

3.3 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. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 055134 - ALUMINUM LADDERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Attic access ladders.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product.
- B. Shop Drawings:
 - 1. Detail fabrication and erection of each ladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.
 - 2. Provide templates for anchors and bolts specified for installation under other Sections.
 - 3. Provide reaction loads for each hanger and bracket.
- C. Qualification Data: Refer to Quality Assurance provisions for submittal requirements evidencing experience, certifications and resources.
- D. Verification Samples: For each finish specified, two samples, minimum size 6 inches square, represent actual product color.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this Project.
- B. Record of successful in-service performance.
- C. Sufficient production capacity to produce required units.
- D. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum ladders that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: 2 years.
- B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Aluminum Ladders: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
 - 1. Precision Ladders LLC. (Basis of Design)
 - 2. O'Keeffe's Inc.
 - 3. Royalite.
 - 4. Alaco.
 - 5. Or equal.

2.2 MATERIALS

- A. Aluminum Fixed Vertical Ladder and Components: Ladder, cage, rest platforms, floor mounting brackets, security doors, walk-thru, and side rails.
 - 1. Capacity: Unit shall support a 1500 lb loading without failure, and individual treads shall withstand a 3,000 lb loading without failure.
 - 2. Performance Standard: Units designed and manufactured to meet or exceed ANSI A14.3 and OSHA 1910.27.

2.3 ATTIC ACCESS LADDERS

- A. Product: Super Simplex Disappearing Stairway by Precision Ladders or equal.
 - 1. Meets requirements of A.N.S.I. A14.9-2010 for "Commercial" or "Residential" use.
 - 2. Test Weight of 500 lbs.
 - 3. Individual tread test weights of 1000 lbs.
 - 4. Actual shear of rivets tested to 1175 lbs.
 - 5. Steel frame.
 - 6. Extruded aluminum treads & side rails.
 - 7. 5 3/16" x 18" (std) clear tread area.
 - 8. Clear tread width varies depending on frame width (22 1/2" min - 39" max).
 - 9. Access door panel.

2.4 ALUMINUM FINISHES

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- A. Mill finish. As extruded.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Anchor securely using fasteners specified by manufacturer or others of equivalent or greater strength and corrosion resistance.

END OF SECTION 055134

SECTION 055213 - 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe and tube railings.
- B. Related Sections:
 - 1. Division 9 Section "Painting" for field painting.

1.3 DEFINITIONS

- A. Exterior: Defined as the following:
 - 1. Areas, locations, and surfaces that are unprotected, or exposed to environmental elements.
 - 2. Areas, locations and surfaces within uncontrolled environments.
 - 3. Areas, locations and surfaces of unconditioned spaces, including belowgrade/underground, partially-exposed, or "covered" parking areas.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails:
 - 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. 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.
 - 3. Infill of Guards:
 - a. Uniform load of 25 lbf/sq. ft. applied horizontally.
 - b. Infill load and other loads need not be assumed to act concurrently.
- B. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.5 SUBMITTALS

- A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.
- B. Welding: Qualify procedures and personnel according to the following:
 1. AWS D1.1, "Structural Welding Code--Steel."
- C. Appearance: Galvanized articles shall be free from uncoated areas, blisters, flux deposits, acid and black spots, and dross inclusions. Lumps, projections, globules, or heavy deposits of zinc which will interfere with the intended use of the material will not be permitted.

1.7 COORDINATION AND SCHEDULING

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of pipe and tube railings that fails in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 2. Warranty Period: 2 years.
- B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Steel Pipe and Tube Railings:
 - 1. Wagner/Braun.
 - 2. Local iron fabricators.
- B. Nonshrink, Nonmetallic Grout:
 - 1. 1107 Advantage Grout by Dayton Superior Chemical & Cement Products.
 - 2. Conset Grout by ChemMasters Specialty Construction Products.
 - 3. General-Purpose Grout by Symons.
 - 4. Or equal.

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.

2.3 STEEL AND IRON

- A. Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).
- B. Pipe: ASTM A 53, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - 1. Provide galvanized finish for exterior installations and where indicated.

2.4 FASTENERS

- A. General: Provide the following:
 - 1. Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated.
 - 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.
- C. Anchors: Provide cast-in-place anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. 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.

2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- 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 surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Form changes in direction as detailed.
- J. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- K. Close exposed ends of railing members with prefabricated end fittings.
- L. 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.

- M. 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 fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- O. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with steel plate forming bottom closure.

2.7 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.8 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
 - 2. Comply with ASTM A 123 for hot-dip galvanized railings.
 - 3. Comply with ASTM A 153 for hot-dip galvanized hardware.
- B. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- D. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.
- E. Preparation for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.
- F. 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 railings:
 - 1. Exterior Railings (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interior Railings (SSPC Zone 1A): SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
- G. 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. Do not apply primer to galvanized surfaces.
 2. Stripe paint corners, crevices, bolts, welds, and sharp edges.
- H. Field Finish: Comply with Division 9 Section "Painting" for field painting.

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 have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- 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 Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.

3.4 ANCHORING POSTS

- A. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been 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. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch buildup, sloped away from post.

- C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

3.5 ADJUSTING AND CLEANING

- A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.6 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 055213

SECTION 064023 - 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 1. Plastic-laminate cabinets.
 2. Plastic-laminate countertops.
 3. Solid-surfacing-material countertops.
 4. Stone countertops.

1.3 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.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 2. Show locations and sizes of cutouts and holes for plumbing fixtures and other items installed in architectural woodwork.
 3. Apply WI-certified compliance label to first page of Shop Drawings and follow Section 1, "Guidelines for Architectural Millwork Shop Drawing".
- C. Samples for Initial Selection: For each type of product indicated requiring product selection.
- D. Samples for Verification:
 1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.
 2. Solid-surfacing materials, 6 inches square.
 3. Corner pieces as follows:
 - a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
 - b. Miter joints for standing trim.

4. Exposed cabinet hardware and accessories, one unit for each type and finish.
 - a. Hardware samples will be returned up on approval.
- E. Product Certificates: For each type of product, signed by product manufacturer.
- F. Woodwork Quality Standard Compliance Certificates for Product and Installation: WI-certified compliance certificates confirming conformance with Certified Compliance Program (CCP).
- G. Qualification Data: For Installer and fabricator.

1.5 QUALITY ASSURANCE

- A. Fabricator 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. Shop is a licensee of WI's Certified Compliance Program.
- B. Installer Qualifications: Licensee of WI's Certified Compliance Program.
- C. Quality Standard: Unless otherwise indicated, comply with WI's "Manual of Millwork" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
 1. Before delivery to job-site, Millwork supplier:
 - a. Licensees of WI shall issue a certified compliance certificate indicating millwork products being furnished for this project, and certifying that these products and their installation, will fully meet requirements of grade or grades specified.
 - b. Non-Licensees of WI shall provide evidence that they have arranged for inspection by WI inspector after completion of fabrication and installation. If conditions are found to be compliant, inspector will issue Compliance Certificate indicating millwork products being furnished for this project, and certifying that these products and their installation, will fully meet requirements of grade or grades specified.
 2. Each elevation of casework and each countertop shall bear certified compliance label.
 3. Cabinet Design Series (CDS): CDS numbers on Drawings indicate typical designs.
- D. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation

areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install 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. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
 - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 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.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of interior architectural woodwork that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 2 years.
- B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. High-Pressure Decorative Laminate: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
 - 1. Formica Corporation. (Basis of Design)

2. Nevamar Company, LLC; Decorative Products Div.
 3. Wilsonart International; Div. of Premark International, Inc.
 4. Or equal.
- B. Solid Surfacing Materials: Subject to compliance with requirements, provide products by one of the following:
1. Caesarstone. (Basis of Design)
 2. Corian.
 3. LG- Quartz.
 4. Avonite.
 5. Hi Macs.
 6. Or equal.
- C. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
1. Medex, Medex NC, Medite II, or Arreis SDF by SierraPine Ltd.
 2. Weyerhaeuser Company; Premier Plus by Weyerhaeuser.
 3. Or equal.
- D. Particleboard: ANSI A208.1, Grade made with binder containing no urea formaldehyde.
1. Rodman Industries, Inc.
 2. Acadia Board Company.
 3. PrimeBoard, Inc.
 4. Or equal.
- E. Cabinet hardware: Subject to compliance with requirements, provide products by one of the following manufacturers.
1. Hafele. (Basis of Design)
 2. Accuride.
 3. Or equal.

2.2 MATERIALS

- A. General: Provide materials that comply with requirements of WI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Core and Substrates: Comply with the following:
1. Hardboard: AHA A135.4.
 2. Medium-Density Fiberboard: ANSI A208.2, Grade MD.
 3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
- C. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges.
- D. High-Pressure Decorative Laminate (HPDL): NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

- E. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
 - 1. Type: Standard type, unless Special Purpose type is indicated.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide the following unless indicated otherwise on Drawings.
- B. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.
 - 1. Product: KV #255 by Knape & Vogt or equal.
- C. Grommets: Plastic, 2 inch diameter, locations as indicated. If locations are not indicated, as selected by Architect during shop drawing review. Doug Mockett, Sugatsune, Wood Technology, or equal.
- D. Drawer and Door Pulls: For all, including accessible casework.
 - 1. Pull and knobs as indicated on Drawings.
- E. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish to key with door hardware. All doors and drawers to be lockable.
- F. Hinges: Concealed (fully mortised) self-closing type, BHMA No. 652, steel with polished finish.
 - 1. Products: Blum or equal.
- G. Drawer Slides: BHMA A156.9, B05091.
 - 1. Heavy Duty (Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides. Model 3640 by Accuride or equal.

2.4 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.
- D. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Wood Glues: 30 g/L.
 - 2. Contact Adhesive: 250 g/L.
- E. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.
 - 2. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.
- D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect 7 days in advance of the dates and times woodwork fabrication will be complete.
 - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
- E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - 1. Seal edges of openings in countertops with a coat of varnish.

2.6 PLASTIC-LAMINATE CABINETS

- A. WI Construction Style: Style A, Frameless.
- B. WI Construction Type: Type I, multiple self-supporting units rigidly joined together.
- C. WI Door and Drawer Front Style: Flush Reveal overlay.
- D. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
 - 1. Both sides of all shelves shall be 0.028 high pressure decorative laminate, regardless of location or exposure, and shall not span more than 34 inches.
 - 2. Shelves shall be retained with seismic clips.
 - 3. Cabinets shall be designed for full use of corners.
 - 4. Upper cabinets shall be at 4'-6" AFF max.
- E. Semi-Exposed Surfaces: Any of one of following.

1. Low pressure decorative polyester overlay.
2. Low pressure decorative melamine overlay.
3. HPL cabinet liner.
4. Solid Phenolic core (SPC).
5. Vinyl at cabinet backs and drawer bottoms only.

F. Concealed Surfaces: Any of one of following.

1. Solid Wood or Plywood: Any hardwood or softwood species, with no defects affecting strength or utility. Hardwood and softwood lumber kiln dried to 7 and 10 percent moisture content, respectively.
2. Particleboard: ANSI A208.1, Grade M-2.
3. Medium-Density Fiberboard: ANSI A208.2.
4. Solid Phenolic core (SPC).

G. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated on Drawings.

2.7 PLASTIC-LAMINATE COUNTERTOPS

A. High-Pressure Decorative Laminate Grade: HGS, 0.048 inches (1.2 mm) thick.

B. Provide Exterior grade plywood at wet locations and comply with following:

1. No seams shall occur within 18 inches of sink cut-outs.
2. Sink cut-outs shall be coated with opaque sealer.
3. Back splash shall coordinate with size of soap and paper tower dispensers for solid attachment.
4. Corners of tops shall be cut at 45 degrees if projecting or in pathway.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated on Drawings.

D. Edge Treatment: Self-edge banded.

E. Laminate Substrates: Medium-density fiber board (MDF). Do not use plywood.

F. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

2.8 SOLID-SURFACING-MATERIAL COUNTERTOPS

A. Solid-Surfacing-Material Thickness: 1/2 inch.

B. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material indicated on Drawings.

C. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

- D. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

2.9 STONE COUNTERTOPS

- A. As indicated on Drawings.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.
- B. Before installing 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 woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.
- C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Maintain veneer sequence matching of cabinets with transparent finish.
 - 3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

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1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 3. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
 4. Calk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."
- H. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.
- I. Refer to Division 9 Sections for final finishing of installed architectural woodwork not indicated to be shop finished.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064023

SECTION 06 1000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Rough carpentry Work.
2. Installation of glued laminated members, plywood web joists or wood chord metal web joists.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 03 1000: Concrete Forming and Accessories.
3. Section 03 3000: Cast-In-Place Concrete.
4. Section 06 2000: Finish Carpentry.
5. Section 09 2900: Gypsum Board.

1.02 SYSTEM DESCRIPTION

A. Regulatory Requirements:

1. Work of this Section shall comply with CBC Chapter 23.

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. Redwood structural and framing lumber shall be graded in accordance with Standard Specifications for Grades of California Redwood Lumber of the Redwood Inspection Service.
2. Douglas fir, larch or hemlock structural and framing lumber shall be graded in accordance with the Standard Grading Rules of the West Coast Lumber Inspection Bureau (WCLIB) or the Western Lumber Grading Rules of the Western Wood Products Association (WWPA).
3. Plywood shall conform to requirements of Product Standard PS 1, and shall be grade marked by a recognized grading agency (APA and PTL).

B. Lumber shall bear official grade mark of the association under whose rules it was graded or official grade mark of another recognized grading agency.

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- C. Structural and framing members 2-inch thick (nominal) and larger shall be air-dried to moisture content not to exceed 19 percent before installation.
- D. Each piece of preservative treated lumber shall be identified by the Quality Mark of an approved inspection agency in accordance with CBC Chapter 23; refer to Section 01 4523: Testing and Inspection.
- E. Lumber showing visible signs of mold growth:
 - 1. Lumber showing visible signs of mold growth shall be removed from the project site or cleaned as outlined below.
 - 2. The contractor is responsible for all costs associated with cleaning, post-cleaning testing, and reporting for lumber with mold.
 - a. Lumber that shows visible signs of mold growth prior to, or after installation, shall be cleaned pursuant to the current edition of USEPA’s guidance publication “Mold Remediation in Schools and Commercial Buildings (EPA 402-K-01-001).
 - b. A minimum of 10 percent of the total locations cleaned must be sampled (tape lift method) post cleaning to ensure cleaning effort was successful. Cleaning will be considered acceptable when tape lift sample results evaluated by direct microscopic examination determine that the general abundance of mold is non-detect or rare (normal trapping to 1+).
 - c. A report prepared by a Certified Industrial Hygienist (CIH) that details the sampling and cleaning results shall be prepared and submitted to the OAR for review and approval of the LAUSD Office of Environmental Health and Safety.
 - d. Cleaned lumber shall not be installed or enclosed by finish materials until approval of test results. Cleaned lumber must meet moisture content requirements as required elsewhere in this specification prior to installation or application of finishes.

1.04 STORAGE, HANDLING AND PROTECTION

- A. The materials supplied as part of the Work of this section shall be protected from exposure to inclement weather before being covered by other Work.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Lumber: Structural and framing lumber shall be of following species and grades:

	<u>INSTALLATION</u>	<u>SPECIES</u>	<u>GRADE</u>
1.	Subfloor, wall sheathing, roof sheathing and ceiling furring	Douglas fir and larch	Construction Board, WCLIB; WWPA

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- | | | | |
|-----|--|-------------------------------|--|
| 2. | Posts, (5-inch by 5-inch and larger, width not more than 2 inches greater than thickness). | Douglas fir and larch | No. 1 or better Structural Posts and Timbers, WCLIB. No. 1 or better Post and Timbers, WWPA. |
| 3. | Beams, girders and truss members (5-inch and thicker, rectangular, width more than 2-inches greater than thickness) where exposed as finish members. | Douglas fir and larch | No. 1 or better Structural Beams and Stringers, WCLIB; WWPA. |
| 4. | Joists, rafters, lintels, posts, mullions and members (2 to 4-inch thick, 2 to 4-inch wide) | Douglas fir and larch | No. 1 or better; Structural Light Framing, WCLIB; |
| 5. | Other lumber (2 to 4-inch thick, 2 to 4-inch wide) not specified in subparagraph 5 above. | Douglas fir and larch | Construction Light Framing WCLIB; WWPA |
| 6. | Framing lumber (2 to 4-inch thick, 5-inch and wider). | Douglas fir and Larch | No. 1 or better Structural Joists and Planks, WCLIB; WWPA. |
| 7. | Mudsills and plates in contact with earth. | Douglas fir and Larch Treated | Same as subparagraphs 5 and 6. |
| 8. | Sills or plates installed on concrete or masonry surfaces 6 inches or less above earth or finish grade. | Douglas fir and Larch Treated | Same as subparagraphs 5 and 6. |
| 9. | Sills, foundation plates and sleepers installed on concrete, masonry foundations, or installed on concrete slab in direct contact with earth. | Douglas fir and Larch treated | Same as subparagraphs 5 and 6. |
| 10. | Miscellaneous nailing strips and blocks embedded in concrete or masonry. | Douglas fir and Larch treated | Same as subparagraphs 5 and 6. |
- B. Plywood: Plywood furnished for structural purposes, when exposed outdoors, shall be exterior type plywood. Other plywood furnished for structural purposes shall be exterior type, or Exposure 1.
- C. OSB Board or Panels:
1. Oriented strand board or panels shall not be furnished as part of the Work of this section.
- D. Preservative Treated Wood:

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1. Wood and plywood specified; as treated wood shall be pressure treated wood in accordance with CBC requirements.
 2. Seasoning: Treated lumber shall be air seasoned after treatment, for a minimum of two weeks before installation. Moisture content shall be 15 percent maximum.
 3. Creosote or arsenic is not permitted for treating wood.
 4. When treated wood member have been notched, dapped, drilled, or cut, such newly cut surfaces shall be painted with a heavy coat of the same preservative material originally provided for treatment of wood member.
- E. Fire Retardant Protection: Wood and plywood specified as fire retardant protected wood shall be treated by approved methods and materials and shall be dried following treatment to maximum moisture content as follows:
1. Solid sawn lumber 2-inch thick or less: 19 percent.
 2. Plywood: 15 percent.
- F. Plywood Subflooring: Underlayment, Group 1, Exposure 1; of thickness indicated.
- G. Mineral Fiber Panels: Asbestos-free, thickness as indicated.
- H. Adhesive: Elastomeric adhesive – follow manufacturer’s installation instructions. Product must be approved by OWNER Office of Environmental Health and Safety and conform to ASTM D 3498 or APA-AFG-01.

PART 3 - EXECUTION

3.01 FASTENINGS

- A. Nails and Spikes:
1. Furnish only common wire nails or spikes whenever indicated, specified or required.
 2. Whenever necessary to prevent splitting, holes shall be pre-drilled for nails and spikes.
 3. Nails in plywood shall not be overdriven.
 4. Machine Applied Nailing: Use of machine nailing is subject to a satisfactory Project site demonstration for each Project and approval by the Architect or structural engineer retained by the Architect as an Architect Consultant and DSA. Installation is subject to continued satisfactory performance. Machine nailing is not permitted for 5/16 inch plywood. Do not permit nail heads to penetrate outer ply. Maintain minimum allowable edge distances when installing nails.
- B. Lag Screws:
1. When installing lag screws in a wood member, pre-drill hole as required by the CBC.

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2. Lag screws, which bear on wood, shall be fitted with standard steel plate washers under head. Lag screws shall be screwed and not driven into place.
- C. Bolts:
1. Lumber and timber to be fastened together with bolts shall be clamped together with holes for bolts bored true to line.
 2. Bolts shall be fitted with steel plates or standard cut washers under heads and nuts. Bolts shall be tightened when installed and again before completion of the Work of this section.
- D. Wood Screws: When installing wood screws, pre-drill holes as required by the CBC.
- E. Metal Framing Devices: Framing anchors, joist hangers, ties, and other mechanical fastenings shall be galvanized or furnished with a rust inhibitive coating. Nails and fastenings shall be of the type recommended by manufacturer.
- F. Powder Driven Fasteners:
1. Loads shall not exceed 75 pounds unless indicated on the Drawings or when reviewed by the Architect.
 2. The operator, tool, and fastener shall perform the following as observed by the Inspector.
 - a. Observe installation of first 10 fasteners.
 - b. Test the first 10 fasteners by performing a pullout test. Load shall be at least twice the design load, or 150 pounds, whichever is greater.
 - c. Random testing:
 - 1) Load less than 75 pounds - approximately 1 in 10 pins.
 - 2) Load 75 pounds or greater - 1/2 of the pins.
 3. Failure of any test will result in testing of all installed pins.
 4. Nail heads shall not break the outer skin of sheathing.
 5. Non-compliant pins shall be replaced.

3.02 INSTALLATION

- A. Stud Walls, Partitions and Furring:
1. Wood stud walls, partitions and vertical furring shall be constructed of members of size and spacing indicated. Provide single treated plate at bottom and double plate at top unless otherwise indicated. Interior, nonbearing non-shear partitions may be framed with a single top plate, installed to provide overlapping at corners and at inter- sections with other wall and partitions or by metal ties as detailed.

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2. Walls and partitions shall be provided with horizontal staggered blocking at least 2 inch nominal thickness and same width as studs, fitted snugly, and nailed into studs. Blocking shall be installed at mid-height of partition or not more than 7 feet on center vertically. Install wood backing on top of top plate wherever necessary for nailing of lath or gypsum board.
3. Walls, partitions and furred spaces shall be provided with 2-inch nominal thickness wood firestops, same width as space to be firestopped, at ceiling line, mid-height of partition and at floor line. Firestops at floor line are not required when floor is concrete. If width of opening is such that more than one piece of lumber is necessary, provide two thicknesses of one inch nominal material installed with staggered joints.
4. Firestops shall be installed in stud walls and partitions, including furred spaces, so the maximum dimension of any concealed space is not over 10 feet.
5. Corners, and where wood stud walls and wood vertical furring meet, shall be constructed of triple studs. Openings in stud walls and partitions shall be provided with headers as indicated and a minimum of 2 studs at jambs, one stud of which may be cut to support header in bearing.
6. Where wood and masonry or concrete walls intersect, end stud shall be fastened at top, bottom and mid-height with one 1/2 inch diameter bolt through stud and embedded in masonry or concrete a minimum of 4 inches. Bolts shall be provided with washers under nuts.
7. Sills under bearing, exterior or shear walls shall be bolted to concrete with 5/8 inch diameter by 12-inch long bolts with nuts and washers, spaced not more than 4 feet on center unless noted otherwise. There shall be a bolt within 9 inches of each end of each piece of sill plate. Sills shall be installed and leveled with shims, washers, with nuts tightened to level bearing. Space between sill and concrete shall be dry packed with cement grout.

B. Floor Joists, Roof and Ceiling Framing:

1. Wood joists shall be of the size and spacing indicated, installed with crown edge up, and shall have at least 4-inch bearing at supports. Provide 2-inch solid blocking, cut in between joists, same depth as joists, at ends and bearings, unless otherwise indicated.
2. Floor joists of more than 4 inches in depth and roof joists of more than 8 inches in depth shall be provided with bridging. Floor joists shall be bridged every 8 feet with solid blocking or metal cross bridging. Roof joists shall be bridged every 10 feet.
3. Joists under and parallel to bearing partitions shall be doubled and nailed or bolted together as detailed. Whenever a partition containing piping runs parallel to floor joists, joists underneath shall be doubled and spaced to permit passage of pipes and blocked with solid blocking spaced at not more than 4 feet intervals.
4. Trimmer and header joists shall be doubled, when span of header exceeds 4 feet. Ends of header joists more than 6 feet long shall be supported by framing anchors or joist hangers unless bearing on a beam, partition, or wall. Tail joists over 12 feet long shall be supported at header by framing anchors or on ledger strips at least 2 by 4.
5. Provide solid blocking between rafters and ceiling joists over partitions and at end supports where indicated.

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C. Subflooring:

1. Floor sheathing: Plywood of thickness and nailing indicated. Install with the face grain direction across supports, end joints staggered and centered over supports. Provide solid blocking under plywood edges where indicated. In addition to nailing, sheets of plywood flooring shall be secured in place with elastomeric adhesive, installed at beams, joints, perimeter supports and panel edges.

D. Roof and Wall Sheathing:

1. Plywood roof sheathing shall be Structural I, Grade C-D, Exposure 1, thickness as indicated.
2. Where exposed roof sheathing is indicated, area shall be sheathed solid with dressed and center matched, V-jointed boards of sizes indicated. Boards shall be installed perpendicular to supports.
3. Soffits of overhanging eaves, where indicated, shall be boxed-in using Group I, Exterior Type, Grade A-C, plywood, thickness as indicated.
4. Plywood for shear walls shall be Structural I, Grade C-D Exterior Type, thickness as indicated. Install with the long dimension parallel or perpendicular to the supports. Blocking shall be provided behind edges not located over supports. Shear wall construction, nailing, and top and bottom anchorage shall be as indicated.
5. Provide and install metal H-clips of required size, midway between rafters at unsupported edge joints of plywood roof sheathing where rafters are spaced at 24 inches on center. Clips shall be Plyclips, by Timber Fasteners Inc., Panel Clips by Simpson Co., USP Structural Connectors, or equal.

E. Attic Space Partitions and Attic Walkways:

1. Attic space partitions shall be constructed of 2 by 4 wood members spaced at 2 feet on center maximum with 5/8 inch gypsum board.
2. Doors in attic space partitions shall be self-closing, of the same sheathing material as partition, constructed with 2 battens and a diagonal brace across back.
3. Shear walls passing through attic space shall be sheathed with 5/8 inch gypsum board on each side.
4. Attic walkways shall be constructed of 2 by 12 planks installed one-inch apart and nailed at each support with three 16d nails.

F. Furring:

1. Rafters or ceiling joists indicated to be furred for support of materials other than acoustical tile shall be furred with 2 by 4 wood members installed at right angles to supports, spaced as indicated and nailed in place. Furring shall be aligned, and bottoms shall be leveled by installing wood shims as required, and nailed as indicated.
2. Furring for protective wall padding in gymnasium shall be 1 by 3 Douglas fir, Construction Boards, S1S1E; applied horizontally to concrete walls at top and bottom of padding panels; and at uniform intermediate spacing not more than 18 inches on

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center. Stripping shall be shimmed where required, aligned to a true plane, and secured to concrete walls with concrete nails at not more than 18 inches on center.

- G. Furring: Where metal furring is not indicated or specified, provide wood furring at points indicated and required for concealing conduit, piping, structural framing or other unfinished materials. Wood furring shall be 2-by studs of required width. Vertical members contacting concrete or masonry shall be attached as specified for anchoring interior wood stud partitions.
- H. Grounds:
1. Provide and set wood grounds at points where wood trim occurs and work is to be plastered. Grounds at 3/4 inch metal lath shall be 5/8 inch thick, net, 1 1/2-inch wide Douglas Fir, S1S. Grounds shall be doubled where trim member exceeds 5-inch width, or wherever indicated. Grounds shall be applied after lath has been installed set plumb, level and true to line.
 2. Apply grounds over wood framed surfaces and lath and securely nail to wood backing at each stud or bearing. Grounds applied over steel channel studs and lath shall be securely nailed at each stud or bearing to nail-blocks provided and installed in metal studs.
 3. Grounds applied to concrete surfaces shall be securely nailed to woodblocks provided and built into concrete.
- I. Nailing Strips and Plates:
1. Provide wood nailing strips, plates and blocking indicated or required. Nailing strips in connection with metal work shall be bolted to metal. Wood nailing blocks for securing grounds shall be built into concrete, or masonry.
 2. Nailing schedule shall comply with CBC requirements.
 3. Treated wood nailing strips for lightweight insulated concrete roof decks at eaves, ridges, rakes, base of curbs and wherever else indicated, shall be provided and installed. Strips shall be treated Douglas fir, 4 inches (nominal) width by thickness of insulated concrete.
- J. Wood Backing: Provide wood backing as indicated and as required to receive plumbing, electrical fixtures and equipment, cabinets, door stop plates and other fixed equipment.
- K. Wood Bucks: Furnish and set wood bucks to form openings for doors and other openings in concrete or masonry walls and in steel stud or channel partitions and furring. Bucks shall be Douglas fir, S1S2E, 2 inches (nominal) thickness and of width indicated or required. Bucks in connection with concrete shall be bolted thereto, and bucks in masonry walls shall be attached by means of strap anchors embedded in masonry joints. Bucks in connection with steel studs and metal channels shall be secured with nails or screws spaced not to exceed 24 inches on centers.
- L. Bench Tops and Backs: Tops and backs shall be 3/4 inch thick asbestos free board, fabricated to minimize number of joints. Edges shall be neatly cut, smoothly finished and joints accurately fitted and butted. Tops and backs shall be secured with countersunk flathead galvanized wood screws. At bench with steel pan, apply with manufacturer's recommended adhesive. Cut and drill as required for Work to be attached to benches.

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3.03 CLEAN UP

- A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.04 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 072100 - BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 1. Concealed thermal and sound insulation.
 2. Soundproofing blanket.

1.3 DEFINITIONS

- A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 1. Surface-Burning Characteristics: ASTM E 84.
 2. Fire-Resistance Ratings: ASTM E 119.
 3. Combustion Characteristics: ASTM E 136.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by 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.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of building insulation that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 2 years.
- B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Glass-Fiber Batt/Blanket Thermal and Sound Insulation: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
 - 1. Johns Manville (JM). (Basis of Design)
 - 2. CertainTeed Corporation.
 - 3. Guardian Fiberglass, Inc.
 - 4. Knauf Fiber Glass.
 - 5. Owens Corning.
 - 6. Lamtec.
 - 7. Or equal.
- B. Soundproofing Blanket:
 - 1. Acoustical Solutions. (Basis of Design)
 - 2. Or equal.

2.2 GLASS-FIBER BATT/BLANKET INSULATION

- A. Unfaced, Glass-Fiber Batt/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; passing ASTM E 136 for combustion characteristics. Glass- fiber bonded with acrylic thermosetting binder.
 - 1. For walls and partitions: Unfaced Batts.
 - 2. Formaldehyde-free, Unfaced Batts by JM or equal.
- B. Sound Attenuation Ratings: Minimum R-11 on interior walls and partitions, unless otherwise indicated on Drawings.

2.3 SOUNDPROOFING BLANKET

- A. Product: AudioSeal soundproofing blanket by Acoustical Solutions or equal.
 - 1. Description: The PrivacyShield® Industrial Absorptive Soundproofing Blanket is a barrier backed sound panel used to block and absorb sound for interior, high-temperature applications. This barrier backed composite can be used in areas with a temperature up to 550° F making them well suited for machinery housings and other industrial applications. These soundproof curtains are composed of a highly durable silicone-coated fiberglass cloth quilted to 1 in. or 2 in. thick fiberglass batting that is reinforced with a 1 lb. per sq. ft. mass loaded vinyl barrier bonded to one side. This product offers the benefits of a noise barrier and a sound absorber. The absorptive quilted fiberglass side of the blanket should face towards the sound you wish to absorb.
- B. Thickness and Color: As indicated on Drawings.

2.4 ACCESSORIES

- A. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inches wide.
- B. Nails or Staples: Steel wire; electroplated, or galvanized; type and size to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

- D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. For preformed insulating units, 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.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. Install insulation 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 cavity, 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.
 - 4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 - 5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

3.5 INSTALLATION OF INSULATION IN CEILINGS

- A. Install insulation to achieve thermal indicated attached to roof or floor deck from below.
- B. Install insulation to roof or floor deck by adhesively attached, spindle-type insulation anchors as follows:
 - 1. Fasten insulation anchors to deck substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
 - 2. After adhesive has dried, install insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below required thickness.
 - 3. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.6 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 072100

SECTION 076500 - FLEXIBLE SHEET FLASHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Flexible sheet flashing for windows, door, parapets, and other openings and where indicated on Drawings.

1.3 SUBMITTALS

- A. Concurrent Review Requirements: Submit submittals of this section with doors and windows sections.
- B. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of flexible sheet flashing.
- C. Shop Drawings: Show locations and extent of flexible sheet flashing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
- D. Samples: For the following products:
 - 1. 12-by-12-inch square of flexible sheet flashing.
- E. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
- F. Qualification Data: For Installer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for flexible sheet flashing.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that is acceptable to flexible sheet flashing manufacturer for installation of flexible sheet flashing required for this Project.
- B. Source Limitations: Obtain flexible sheet flashing materials through one source from a single manufacturer.

- C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup with doors and windows.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to flexible sheet flashing including, but not limited to, the following:
 - 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 and discuss the flashing to be coordinated with the finishing of doors and windows.
 - 3. Review, discuss, and coordinate the interrelationship of flexible flashing with other exterior wall components. Include provisions for sealants and fasteners.
 - 4. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
 - 5. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by flexible sheet flashing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Store rolls according to manufacturer's written instructions.
- E. Protect stored materials from direct sunlight.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of flexible sheet flashing that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 2 years.
- B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Flexible Sheet Flashing: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.

1. Vycor Plus by WR Grace (Basis of Design).
2. FortiFlash by Fortifiber.
3. FlexWrap and StraightFlash by DuPont.
4. Or equal.

2.2 FLEXIBLE SHEET FLASHING

- A. Self-Adhered, cross-laminated high-density polyethylene (HDPE) sheet, backed by aggressive pressure-sensitive rubberized asphalt adhesive.
1. Thickness: 25 mil minimum per ASTM D3767, Method A.
 2. Low temperature flexibility: Unaffected at minus 45 degrees F. per ASTM D1970.
 3. Elongation, ultimate failure of rubberized asphalt: 200 percent minimum per ASTM D412.
 4. Cracked cycling 100 cycles: Unaffected at minus 25 degrees F. per ASTM C836.
 5. Lap adhesion at minimum application temperature: 60 plf width per ASTM D1876 modified.
 6. Adhesion to concrete at minimum application temperature: 60 plf width per ASTM D903.
 7. ICBO: ER-6141.
 8. Recommended exposure limit: 30 days.
 9. Perm-A-Barrier by Grace is not acceptable.

2.3 AUXILIARY MATERIALS

- A. Mastic, Joint Sealant, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by flexible sheet flashing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
1. Verify that concrete has cured and aged for minimum time period recommended by flexible sheet flashing manufacturer.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install flexible sheet flashing in accordance with the manufacturer's written instructions, AAMA Publication 2400, and the applicable code.

END OF SECTION 076500

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Roof hatches.
- B. Related Sections:
 - 1. Division 5 Section "Aluminum Ladders" for metal ladders, to roof hatches.
 - 2. Division 9 Section "Painting" for field finishes.

1.3 SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of roof accessories that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: 2 years.
- B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Roof Hatches: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
 - 1. Bilco Company (The). (Basis of Design)
 - 2. Milcor Inc.; a Gibraltar Company.
 - 3. Nystrom, Inc.
 - 4. O'Keeffe's Inc.
 - 5. ThyCurb; Div of Thybar Corporation.
 - 6. Or equal.

2.2 METAL MATERIALS

- A. Galvanized Steel Sheet: ASTM A 653, G90 coated and mill phosphatized for field painting.
 - 1. Comply with Division 9 Section "Painting" for field finishes.

2.3 ROOF HATCHES

- A. General: Fabricate roof hatches with integral deck mounting flange and lid frame counterflashing. Fabricate with welded or mechanically fastened and sealed corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.
- B. Product: Type S or E depending on size by Bilco or equal.
 - 1. Type: Galvanized 14 gauge paint bond G-90 galvanized steel single (S) or double-leaf(E) lid as indicated on Drawings.
 - 2. Size: As indicated on Drawings.

3. Cover:
 - a. 3 inch beaded flange with formed reinforcing members. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.
 - b. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
 - c. Operation of the cover shall not be affected by temperature.
 - d. Entire hatch shall be weather tight with fully welded corner joints on cover and curb.
4. Cover insulation: Shall be fiberglass of 1 inch thickness, fully covered and protected by a metal liner 22 gauge paint bond G-90 galvanized steel.
5. Curb: 12 inch in height with integral capflashing, 1 inch fiberboard insulation, fully welded at corners, and 3-1/2 inch mounting flange with 7/16 inch holes provided for securing frame to the roof deck.
6. Curb insulation: Shall be rigid, high-density fiberboard of 1 inch thickness on outside of curb.
7. Ladder Safety Post: Manufacturer's standard ladder safety post. Post to lock in place on full extension. Provide release mechanism to return post to closed position.
8. Factory Prime Finish:
 - a. Steel: Alkyd base red oxide primer.
9. Field Finish: Comply with Division 9 Section "Painting".
10. Hardware
 - a. Heavy pintle hinges shall be provided
 - b. Cover shall be equipped with a spring latch with interior and exterior turn handles
 - c. Roof hatch shall be equipped with interior and exterior padlock hasps.
 - d. The latch strike shall be a stamped component bolted to the curb assembly.
 - e. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1" diameter red vinyl grip handle to permit easy release for closing.
 - f. Compression spring tubes shall be Type 316 stainless steel hardware.
 - g. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

2.4 FINISH

- A. Field finish per Division 9 Section "Painting".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
 2. Verify dimensions of roof openings for roof accessories.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Install roof accessories to fit substrates and to result in watertight performance.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
 - 2. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.
- D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
- E. Roof Hatch Installation:
 - 1. Check roof hatch for proper operation. Adjust operating mechanism as required. Clean and lubricate joints and hardware.

3.3 TOUCH UP

- A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Division 9 painting Sections.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.4 CLEANING

- A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION 077200

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes:
 - 1. Through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, whether indicated on drawings or not, and other openings indicated.
- B. Related Sections include the following:
 - 1. Division 7 Section "Fire-Resistive Joint Systems."
 - 2. Division 7 Section "Joint Sealants" for non-fire-resistive joint sealants.

1.3 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
 - 1. Fire-resistance-rated walls including fire walls, fire partitions, fire barriers, and smoke barriers.
 - 2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:
 - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - a. Penetrations located outside wall cavities.
 - b. Penetrations located outside fire-resistance-rated shaft enclosures.
 - 3. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 3.0 cfm/sq. ft at both ambient temperatures and 400 deg F.

- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 - 2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
 - 3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.
 - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
 - 2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- C. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
 - 1. Types of penetrating items.
 - 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
 - 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
- D. Qualification Data: For Installer.
- E. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted

in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

- B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.
- C. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
 - 1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
 - 2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:
 - a. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.
- D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's inspecting agency and building inspector, if required by authorities having jurisdiction.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of through-penetration firestop system that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 2 years.
- B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Through-Penetration Firestop Systems: Subject to compliance with requirements, provide one of the through-penetration firestop systems for each application that are produced by one of the following manufacturers.
 - 1. Hilti, Inc.
 - 2. Specified Technologies Inc.
 - 3. 3M; Fire Protection Products Division.
 - 4. Or equal.

2.2 FIRESTOPPING, GENERAL

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-/rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.3 FILL MATERIALS

- A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.
- B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
- D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
- F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- H. 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.
- I. 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.
- J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

- K. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
 - 2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
 - 3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

2.4 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop 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 work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system 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 through-penetration firestop systems.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to

remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 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 Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:
 - 1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Through-penetration firestop system designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Through-penetration firestop system manufacturer's name.
 - 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified, independent inspecting agency to inspect through-penetration firestops. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.

- B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.
- C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.6 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop 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 through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.7 THROUGH-PENETRATION FIRESTOP SYSTEM LOCATION

- A. For penetrations by non combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following materials are acceptable:
 - 1. Hilti FS 601 Elastomeric Firestop Sealant.
 - 2. Hilti FS ONE High Performance Intumescent Firestop Sealant.
 - 3. 3M Fire Stop Sealant 2000 4. 3M Fire Barrier CP25 WB.
 - 4. Tremco Tremstop Fyre Sil Sealant.
 - 5. Or equal.
- B. For penetrations by combustible items (penetrants consumed by high heat aflame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe (closed piping systems) the following materials are acceptable:
 - 1. Hilti FS ONE High Performance Intumescent Firestop Sealant.
 - 2. Hilti CP 618 Firestop Putty.
 - 3. Hilti CP 642 Firestop Jacket.
 - 4. Hilti CP 643 Firestop Jacket.
 - 5. 3M Fire Barrier CP25 WB.
 - 6. 3M Fire Barrier FS 195 Wrap/Strip.
 - 7. Tremco Tremstop WBM Intumescent Firestop Sealant.
 - 8. Or equal.
- C. For penetrations by combustible plastic pipe (open piping systems), the following materials are acceptable:
 - 1. Hilti CP 642 Firestop Jacket.
 - 2. Hilti CP 643 Firestop Jacket.
 - 3. Hilti FS ONE High Performance Intumescent Firestop Sealant.
 - 4. 3M Fire Barrier PPO Plastic Pipe Device.
 - 5. Or equal.

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- D. For large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways' the following materials are acceptable:
1. Hilti FS 635 Trowelable Firestop Compound.
 2. Hilti FIRE BLOCK.
 3. 3M Firestop Foam 2001.
 4. 3M Fire Barrier CS 195 Composite Sheet.
 5. Or equal.

END OF SECTION 078413

SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes fire-resistive joint systems for interruptions to fire rated assemblies, whether indicated on drawings or not, and other openings indicated.
- B. Related Sections include the following:
 - 1. Division 7 Section "Penetration Firestopping" for systems installed in openings in walls and floors with and without penetrating items.
 - 2. Division 7 Section "Joint Sealants" for non-fire-resistive joint sealants.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed.
- B. Joint Systems in and between Fire-Resistance-Rated Constructions: Provide systems with assembly ratings equaling or exceeding the fire-resistance ratings of construction that they join, and with movement capabilities and L-ratings indicated as determined by UL 2079.
 - 1. Load-bearing capabilities as determined by evaluation during the time of test.
- C. For fire-resistive systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed; also show relationships to adjoining construction. Include fire-resistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.
 - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.

- C. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.
- D. Qualification Data: For Installer.
- E. Field quality-control test reports.
- F. Evaluation Reports: Evidence of fire-resistive joint systems' compliance with ICBO ES AC30, from the ICBO Evaluation Service.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."
- B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.
- C. Source Limitations: Obtain fire-resistive joint systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
 - 1. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.
 - 2. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:
 - a. Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.
 - b. Fire-resistive joint systems correspond to those indicated by referencing system designations of the qualified testing and inspecting agency.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.
- C. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector of authorities having jurisdiction have examined each installation.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fire-resistive joint systems that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 2 years.
- B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Fire-Resistive Joint Systems: Subject to compliance with requirements, provide one of the through-penetration firestop systems for each application that are produced by one of the following manufacturers.
 - 1. Hilti, Inc.
 - 2. Specified Technologies Inc.
 - 3. 3M; Fire Protection Products Division.
 - 4. Or equal.

2.2 FIRE-RESISTIVE JOINT SYSTEMS

- A. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.

- B. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates or damaging adjoining surfaces.

3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.
- B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
2. Apply fill materials so they contact and adhere to substrates formed by joints.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

- A. Inspecting Agency: Engage a qualified independent inspecting agency to inspect fire-resistive joint systems and prepare inspection reports.
- B. Testing Services: Inspecting of completed installations of fire-resistive joint systems shall take place in successive stages as installation of fire-resistive joint systems proceeds. Do not proceed with installation of joint systems for the next area until inspecting agency determines completed work shows compliance with requirements.
 1. Inspecting agency shall state in each report whether inspected fire-resistive joint systems comply with or deviate from requirements.
- C. Remove and replace fire-resistive joint systems where inspections indicate that they do not comply with specified requirements.
- D. Additional inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- E. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and fire-resistive joint systems comply with requirements.

3.5 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint 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 fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.6 FIRE-RESISTIVE JOINT SYSTEM LOCATION

- A. For fire rated construction joints and other gaps, the following materials are acceptable:
 1. FS 601 Elastomeric Firestop Sealant by Hilti.
 2. CP 601 s Elastomeric Firestop Sealant by Hilti.
 3. CP 606 Flexible Firestop Sealant by Hilti.
 4. CP 672 Firestop Joint Spray by Hilti.
 5. Firestop Sealant 2000 by 3M.
 6. Tremstop Fyre Sil Sealant by Tremco.

7. Or equal.
- B. For openings between structurally separate sections of wall and floors. Top of walls, the following materials along with Thermafiber Safing are acceptable:
1. FS 60t Elastomeric Firestop Sealant by Hilti.
 2. CP 601s Elastomeric Firestop Sealant by Hilti.
 3. CP 606 Flexible Firestop Sealant. by Hilti
 4. FS ONE High Performance Intumescent Firestop Sealant by Hilti.
 5. Fire Barrier CP 25 WB by 3M.
 6. Or equal.
- C. Firestopping at Electrical Boxes and Utility Outlets.
1. CP 618 Firestop Putty Stick by Hilti.
 2. CP 617 and CP 617L Firestop Putty Pad by Hilti.
 3. Or equal.

END OF SECTION 078446

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes joint sealants.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. 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.
- C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- D. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.
- E. Qualification Data: For Installer.
- F. Compatibility and Adhesion 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 needed for adhesion.
- G. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.
- H. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.6 PROJECT 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. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: 2 years.
- B. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
 - 1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
 - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.
- C. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: 2 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Joint Sealants: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
 - 1. Pecora Corporation. (Basis of Design)
 - 2. Bostik.
 - 3. Dow Corning Corp.
 - 4. GE Plastics.
 - 5. Sonneborn Building Products, ChemRex, Inc.
 - 6. Tremco, Inc.
 - 7. Or equal.

2.2 MATERIALS, 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 sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants:
 - 1. As selected by Architect from manufacturer's full range.
 - 2. Areas where concrete joint sealant will be adjacent to concrete other than standard gray, sealant color shall match adjacent color as approved by Architect.

2.3 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 joint-sealant performance.

- 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, blast cleaning, 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.
 - 3. Remove laitance and form-release agents from concrete.
 - a. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on 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 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. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- D. Install sealant backings of type 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.

- E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- F. 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.
- G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified 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 configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
 - 4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.
 - 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- H. Installation of Preformed Tapes: Install according to manufacturer's written instructions.
- I. 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.
- J. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.

3.4 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.

3.5 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 and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT LOCATION

- A. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C 834, Type OP, Grade NF single component, paintable.
 - 1. Products:
 - a. AC-20 manufactured by Pecora.
 - 2. Color: Standard colors matching finished surfaces.
 - 3. Applications:
 - a. Interior wall and ceiling control joints.
 - b. Joints between door and window frames and wall surfaces.
 - c. Other interior joints for which no other type of sealant is indicated.
- B. Bathtub/Tile Sealant: Silicone; ASTM C 920, Uses I, M and A; single component, mildew resistant.
 - 1. Products:
 - a. 898 Silicone Sanitary Sealant by Pecora.
 - 2. Color: Match adjacent color.
 - 3. Applications:
 - a. Joints between plumbing fixtures and floor and wall surfaces.
 - b. Joints between restroom countertops and wall surfaces.
- C. Acoustical Sealant: Butyl or acrylic sealant; ASTM C 920, Grade NS, Class 12-1/2, Uses M and A; single component latex sealant.
 - 1. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Quietseal Pro by QuietRock or equal. (Basis of Design)
 - b. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - c. USG Corporation; SHEETROCK Acoustical Sealant.
 - d. Or equal.
 - 2. Acoustical Sealant for Concealed Joints:
 - a. Quietseal Pro by QuietRock or equal. (Basis of Design)
 - b. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
 - c. Pecora Corporation; BA-98.
 - d. Tremco, Inc.; Tremco Acoustical Sealant.
 - e. Or equal.
- D. Interior Floor Joint Sealant: Polyurethane, chemically-curing, cold-applied, self-leveling elastomeric sealant; ASTM C 920, Grade P, Class 25, Uses T, M and A; two-part.
 - 1. Products:
 - a. NR-200 self-leveling polyurethane and/or DYNATRED non-sag, traffic-grade polyurethane sealants by Pecora.
 - 2. Primer: P-150, P-75 or P-200.
 - 3. Color: Standard colors matching finished surfaces.

4. Applications: Use for joints up to 1-1/2 inches.
 - a. Expansion joints in floors.

- E. Sanitary Sealants: Provide ASTM C920, Type S, Grade NS, Class 25, Use NT. When fully cured and washed, sealant shall meet the requirements of the Food and Drug Administration Regulation 21 CFR 177.2600 for use in areas where sealant comes in contact with food.
 1. Color: As selected by Architect from manufacturer's full range.
 2. Backer Rod shall be closed-cell polyethylene rod stock, larger than joint width.

- F. Butyl Sealant: ASTM C 920, Grade NS, Class 12-1/2, Uses NT, M, A, G, O; single component, solvent release, non-skinning, non-sagging.
 1. Products:
 - a. BC-158 sealant by Pecora.
 2. Color: Standard colors matching finished surfaces.
 3. Movement Capability: Plus and minus 12-1/2 percent.
 4. Service Temperature Range: -13 to 180 degrees F.
 5. Shore A Hardness Range: 10 to 30.

- G. Silicone Sealant: ASTM C 920, Grade NS, Class 25, Uses NT, A, G, M, O; single component, solvent curing, non-sagging, non-staining, fungus resistant, non-bleeding.
 1. Products:
 - a. 864 LM Architectural silicone or 890 silicone sealant by Pecora.
 - b. 790 by Dow Corning Corporation.
 2. Color: Standard colors matching finished surfaces.
 3. Movement Capability: Plus and minus 25 percent.
 4. Applications:
 - a. Interior or exterior for joints 1/8 to 1-1/2 inch wide.
 - b. Exterior use at expansion joints in masonry where substantial movement is expected.
 - c. Glazing application.

END OF SECTION 079200

SECTION 081433 - STILE AND RAIL WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Stile and rail doors.
 - 2. Wood frames.
- B. Related Sections:
 - 1. Division 9 Section "Painting" for painting of wood doors.
 - 2. Division 8 Section "Glazing" for glass vision panels in stile and rail wood doors.

1.2 SUBMITTALS

- A. Product Data: For each type of door.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and other pertinent data.
- C. Samples: For each species and finish required.

1.3 QUALITY ASSURANCE

- A. Quality Standard for Doors of Stock Design and Construction: Comply with WDMA I.S.6A, "Industry Standard for Architectural Stile and Rail Doors."
- B. Safety Glass: Provide products complying with testing requirements in 16 CFR 1201, for Category II materials, unless those of Category I are expressly indicated and permitted.

1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by manufacturer, installer and contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, and have warped (bow, cup or twist) more than 1/4 inch in a 42-by- 84 inch section.
 - 1. Doors: 2 years.

- B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Stile and Rail Doors and Frames: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
 - 1. Masonite (Marshfield-Algoma, Graham-Maiman) Inc.
 - 2. Eggers Industries; Architectural Door Division (VT Industries).
 - 3. Or equal.

2.2 MATERIALS

- A. Assemble doors, including components, with WDMA Type II adhesives.
- B. Provide doors made with adhesives that do not contain urea-formaldehyde resins.
- C. Provide interior doors made with composite wood products that have urea-formaldehyde emission levels below the published maximums in the ANSI A208.1-latest edition Particleboard standard.

2.3 STILE AND RAIL WOOD DOORS

- A. WDMA Grade for Opaque Finish: Custom.
 - 1. Wood Species for Opaque Finish: Manufacturer's standard mill option species and cut for stiles and rails; with panels of same species or wood-based composite materials.
- B. Size, Layout and Thickness: As shown on Drawings.

2.4 NON-RATED WOOD DOOR FRAMES

- A. Solid lumber frame, complete with casings.
- B. Flat jambs:
 - 1. Applied door stops, solid lumber - long, loose, and unmitered.

2.5 FABRICATION

- A. Fabricate stile and rail wood doors in sizes indicated for Project-site fitting.
- B. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting.
- C. Factory machine doors for hardware that is not surface applied.

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- D. Glazed Openings: Glaze doors at factory with glass of type and thickness indicated, complying with Division 8 Section "Glazing." Glaze doors using solid wood moldings for non fire-rated.
- E. Transom and Side Panels: Fabricate panels to match adjoining doors in materials, finish, and quality of construction.

2.6 SHOP PRIMING

- A. Doors for Opaque Finish: Shop apply one coat of wood primer specified in Division 9 Section "Painting" to faces, edges and tops and bottoms of doors.

2.7 FINISH

- A. Field painted per Division 9 Section "Painting".

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood doors to comply with manufacturer's written instructions and with referenced quality standard, and as indicated.
- B. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

END OF SECTION 081433

SECTION 083113 - 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Access doors and frames for walls and ceilings.
- B. Related Sections include the following:
 - 1. Division 9 Section "Painting" for field applied finishes.

1.3 SUBMITTALS

- A. Product Data: For each type of access door and frame indicated. Include construction details, materials, individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.
- D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.
- E. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.
- B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of access doors and frames that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: 2 years.
- B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Access Doors and Frames: Subject to compliance with requirements, provide products by one of the following:
 - 1. Karp Associates Inc.
 - 2. Acudor.
 - 3. Milcor Inc.
 - 4. Nystrom, Inc.
 - 5. Or equal.

2.2 STEEL MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36.
 - 1. ASTM A 123, for galvanizing steel and iron products.
 - 2. ASTM A 153, for galvanizing steel and iron hardware.
- B. Steel Sheet: Cold-rolled steel sheet substrate complying with ASTM A 1008, Commercial Steel (CS), exposed.
- C. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Factory Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 - 2. Field Finish: Factory prime for field painting as specified in Division 9 "Painting".

- D. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.3 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Model RDW by Karp.
 - 1. Type: Recessed door to receive drywall.
 - 2. Frame shall be 14 gage steel and doors shall be 16 gage steel.
 - 3. Door shall be recessed 1 inch.
 - 4. Trim shall be galvanized steel dry wall bead.
 - 5. Hinge shall be concealed pivoting rod type.
 - 6. Locks shall be flush and screwdriver operated with stainless steel cam and studs, or shall be key operated cylinder lock with automatic dust shutter.
 - 7. Finish shall be prime coat of rust inhibitive electrostatic powder, baked grey coat.
 - 8. Door Sizes: As indicated on Drawings.

2.4 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 panels to types of supports indicated.
 - 1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 - 1. For cylinder lock, furnish two keys per lock and key all locks alike.

2.5 FINISHES

- A. Field finish per Division 9 Section "Painting".

PART 3 - EXECUTION

3.1 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.

3.2 ADJUSTING AND CLEANING

- 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 083113

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Door hardware.

1.2 REFERENCES:

A. Use date of standard in effect as of Bid date.

1. American National Standards Institute
 - a) ANSI 156.18 – Materials and Finishes.
2. BHMA – Builders Hardware Manufacturers Association
3. 2019 California Building Code
 - a) Chapter 11B – Accessibility To Public Buildings, Public Accommodations, Commercial Buildings and Public Housing
4. DHI – Door and Hardware Institute
5. NFPA – National Fire Protection Association
 - a) NFPA 80 2016 Edition – Standard for Fire Doors and Other Opening Protectives.
 - b) NFPA 105 – Smoke and Draft Control Door Assemblies
 - c) NFPA 252 – Fire Tests of Door Assemblies
6. UL – Underwriters Laboratories
 - a) UL10C – Positive Pressure Fire Tests of Door Assemblies.
 - b) UL 305 – Panic Hardware
7. WHI – Warnock Hersey Incorporated State of California Building Code
8. Local applicable codes
9. SDI – Steel Door Institute
10. WI – Woodwork Institute
11. AWI – Architectural Woodwork Institute
12. NAAMM – National Association of Architectural Metal Manufacturers

B. Abbreviations

1. Manufacturers: see table at 2.1.A of this section
2. Finishes: see 2.7 of this section.

1.3 SUBMITTALS & SUBSTITUTIONS

- A. SUBMITTALS:** Submit six copies of schedule per D. Only submittals printed one sided will be accepted and reviewed. Organize vertically formatted schedule into “Hardware Sets” with index of doors and headings, indicating complete designations of every item required for each door or opening. Minimum 10pt font size. Include following information:
1. Type, style, function, size, quantity and finish of hardware items.
 2. Use BHMA Finish codes per ANSI A156.18.
 3. Name, part number and manufacturer of each item.
 4. Fastenings and other pertinent information.
 5. Location of hardware set coordinated with floor plans and door schedule.
 6. Explanation of abbreviations, symbols, and codes contained in schedule.
 7. Mounting locations for hardware.
 8. Door and frame sizes, materials and degrees of swing.
 9. List of manufacturers used and their nearest representative with address and phone number.
 10. Catalog cuts.
 11. Date of jobsite visit.
- B.** Bid and submit manufacturer’s updated/improved item if scheduled item is discontinued.
- C.** Deviations: Highlight, encircle or otherwise identify deviations from “Schedule of Finish Hardware” on submittal with notations clearly designating those portions as deviating from this section.
- D.** If discrepancy between drawings and scheduled material in this section, bid the more expensive of the two choices, note the discrepancy in the submittal and request direction from Architect for resolution.
- E.** Substitutions per Division 1. Include product data and indicate benefit to the Project. Furnish operating samples on request.
- F.** Items listed with no substitute manufacturers have been requested by Owner to meet existing standard.
- G.** Furnish as-built/as-installed schedule with closeout documents, including keying schedule, riser and point-to-point wiring diagrams, manufacturers’ installation, adjustment and maintenance information, and supplier’s final inspection report.

1.4 QUALITY ASSURANCE:

- A. Qualifications:**
1. Hardware supplier: direct factory contract supplier who employs a hardware consultant, available at reasonable times during course of work for project hardware consultation to Owner, Architect and Contractor.
 - a) Responsible for detailing, scheduling and ordering of finish hardware. Detailing implies that the submitted schedule of hardware is correct and complete for the intended function and performance of the openings.
- B. Hardware:** Free of defects, blemishes and excessive play. Obtain each kind of hardware (latch and locksets, exit devices, hinges and closers) from one manufacturer.

- C. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.
- D. Fire-Rated Openings: NFPA 80 compliant. Hardware UL10C (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved-bearing hinges, and resilient seals. Coordinate with wood door section for required intumescent seals. Furnish openings complete.
- E. Furnish hardware items required to complete the work in accordance with specified performance level and design intent, complying with manufacturers' instructions and code requirements.
- F. Pre-Installation Meetings: Initiate and conduct with supplier, installer and related trades, coordinate materials and techniques, and sequence complex hardware items and systems installation. Include manufacturers' representatives of locks, panic hardware and door closers in the meetings. Convene prior to commencement of related work.

1.5 DELIVERY, STORAGE AND HANDLING:

- A. Delivery: coordinate delivery to appropriate locations (shop or field).
 - 1. Permanent keys and cores: secured delivery direct to Owner's representative.
- B. Acceptance at Site: Items individually packaged in manufacturers' original containers, complete with proper fasteners and related pieces. Clearly mark packages to indicate contents, locations in hardware schedule and door numbers.
- C. Storage: Provide securely locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, dust, excessive heat and cold, etc.

1.6 PROJECT CONDITIONS AND COORDINATION:

- A. Electrified hardware: Electrical drawings and electrical specifications are based on the specific electrified hardware components specified in hardware sets. These electronic hardware components have been specified as an assembly. Changes to these components shall be submitted to the Architect for approval.
- B. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical the same operation and quality as type specified, subject to Architect's approval.
- C. Coordination: Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents. Furnish related trades with the following information:
 - 1. Location of embedded and attached items to concrete.
 - 2. Location of wall-mounted hardware, including wall stops.
 - 3. Location of finish floor materials and floor-mounted hardware.

4. At masonry construction, coordinate with the anchoring and hollow metal supplier prior to frame installation by placing a strip of insulation, wood, or foam, on the back of the hollow metal frame behind the rabbet section for continuous hinges, as well as at rim panic hardware strike locations, silencers, coordinators, and door closer arm locations. When the frame is grouted in place, the backing will allow drilling and tapping without dulling or breaking the installer's bits.
 5. Locations for conduit and raceways as needed for electrical, electronic and electro-pneumatic hardware items. Fire/life-safety system interfacing. Point-to-point wiring diagrams plus riser diagrams to related trades.
 6. Coordinate: flush top rails of doors at outswinging exteriors, and throughout where adhesive-mounted seals occur.
 7. Manufacturers' templates to door and frame fabricators.
- D. Check Shop Drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation.
- E. Environmental considerations: segregate unused recyclable paper and paper product packaging, uninstalled metals, and plastics, and have these sent to a recycling center.
- F. Prior to submittal, carefully inspect existing conditions to verify finish hardware required to complete Work, including sizes, quantities, existing hardware scheduled for re-use, and sill condition material. If conflict between the specified/scheduled hardware and existing conditions, submit request for direction from Architect. Include date of jobsite visit in the submittal.
1. Submittals prepared without thorough jobsite visit by qualified hardware expert will be rejected as non-compliant.

1.7 WARRANTY:

- A. Part of respective manufacturers' regular terms of sale. Provide manufacturers' written warranties.
- B. Include factory order numbers with close-out documents to validate warranty information, required for Owner in making future warranty claims:
- C. Minimum warranties:
- | | | |
|----|------------------------------------|-------------------------|
| 1. | Locksets: | Three years |
| 2. | Extra Heavy Duty Cylindrical Lock: | Seven Years |
| 3. | Exit Devices: | Three years mechanical |
| 4. | Closers: | Thirty years mechanical |
| 5. | Hinges: | One year |
| 6. | Other Hardware | Two years |

1.8 COMMISSIONING:

- A. Conduct these tests prior to request for certificate of substantial completion:
1. With installer present, test door hardware operation with climate control system and stairwell pressurization system both at rest and while in full operation.

2. With installer, access control contractor and electrical contractor present, test electrical, electronic and electro-pneumatic hardware systems for satisfactory operation.
3. With installer and electrical contractor present, test hardware interfaced with fire/life-safety system for proper operation and release.

1.9 REGULATORY REQUIREMENTS:

- A. Locate latching hardware between 34 inches to 44 inches above the finished floor, per 2019 California Building Code, Section 11B-404.2.7.
 1. Panic hardware: locate between 36 inches to 44 inches above the finished floor.
- B. Handles, pull, latches, locks, other operable parts:
 1. Readily openable from egress side with one hand and without tight grasping, tight pinching, or twisting of the wrist to operate. 2019 California Building Code Section 11B-309.4.
 2. Force required to activate the operable parts: 5.0 pounds maximum, per 2019 California Building Code Section 11B-309.4.
- C. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors. As allowed per 2019 California Building Code Section 11B-404.2.9, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15-pounds.
 1. Exception: exterior doors' pressure-to-open may be increased to 8.5-pounds if: at a single location, and one of a bank of eight leafs or fraction of eight, and one leaf of this bank is fitted with a low- or high-energy operator.
- D. Low-energy powered doors: comply with ANSI/BHMA A156.19. Reference: 2019 California Building Code Section 11B-404.2.9.
 1. Where powered door serves an occupancy of 100 or more, provide back-up battery power or stand-by generator power, capable of supporting a minimum of 100 cycles.
 2. Actuators, vertical bar type: minimum 2-inches wide, 30-inches high, bottom located minimum 5-inches above floor or ground, top located minimum 35-inches above floor or ground. Displays International Symbol of Accessibility, per 2019 California Building Code Section 11B-703.7.
 3. Actuators, plate type: use two at each side of the opening. Minimum 4-inches diameter or 4-inches square. Displays International Symbol of Accessibility, per 2019 California Building Code Section 11B-703.7. Locate centerline of lower plate between 7- and 8-inches above floor or ground, and upper plate between 30- and 44-inches above floor or ground.
 4. Actuator location: conspicuously located, clear and level floor/ground space for forward or parallel approach.
- E. Adjust door closer sweep periods so that from an open position of 90 degrees, the door will take at least 5 seconds to move to a point 12 degrees from the latch, measured to the landing side of the door, per 2019 California Building Code Section 11B-404.2.8.
 1. Spring hinges: adjust for 1.5 seconds minimum for 70 degrees to fully-closed.

- F. Smooth surfaces at bottom 10 inches of push sides of doors, facilitating push-open with wheelchair footrests, per 2019 California Building Code Section 11B-404.2.10.
 - 1. Applied kickplates and armor plates: bevel the left and right edges; free of sharp or abrasive edges.
 - 2. Tempered glass doors without stiles: bottom rail may be less than 10 inches if top leading edge is tapered 60 degrees minimum.
- G. Door opening clear width no less than 32 inches, measured from face of frame stop, or edge of inactive leaf of pair of doors, to door face with door opened to 90 degrees. Hardware projection not a factor in clear width if located above 30 inches and below 80 inches, and the hardware projects no more than 4 inches. 2019 California Building Code Section 11B-404.2.3.
 - 1. Exception: doors not requiring full passage through the opening, that is, to spaces less than 24 inches in depth, may have the clear opening width reduced to 20 inches. Example: shallow closets.
 - 2. Door closers and overhead stops: not less than 78 inches above the finished floor or ground, per 2019 California Building Code 11B-307.4.
- H. Thresholds: floor or landing no more than 0.50 inches below the top of the threshold of the doorway, per 2019 California Building Code Section 11B-404.2.5. Vertical rise no more than 0.25 inches, change in level between 0.25 inches and 0.50 inches: beveled to slope no greater than 1:2 (50 percent slope). 2019 California Building Code Section 11B-303.2 & ~.3.
- I. Floor stops: Do not locate in path of travel. Locate no more than 4 inches from walls, per DSA Policy #99-08 (Access).
- J. Pairs of doors with independently-activated hardware both leafs: limit swing of right-hand or right-hand-reverse leaf to 90 degrees to protect persons reading wall-mounted tactile signage, per 2019 California Building Code Section 11B-703.4.2.
- K. Door and door hardware encroachment: when door is swung fully-open into means-of-egress path, the door may not encroach/project more than 7 inches into the required exit width, with the exception of door release hardware such as lockset levers or panic hardware. These hardware items must be located no less than 34-inches and no more than 48-inches above the floor/ground. 2019 California Building Code, Section 1005.7.1.
 - 1. In I-2 occupancies, surface mounted latch release hardware, mounted to the side of the door facing away from the adjacent wall where the door is in the open position, is not exempt from the inclusion in the 7-inch maximum encroachment, regardless of its mounting height, per 2019 California Building Code, Section 1005.7.1 at Exception 1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Listed acceptable alternate manufacturers: these will be considered; submit for review products with equivalent function and features of scheduled products.

ITEM:	MANUFACTURER:	ACCEPTABLE ALTERNATE:
Hinges	(IVE) Ives	Stanley
Key System	(SCH) Schlage	As directed by Architect/Owner
Mechanical Locks	(SCH) Schlage	As directed by Architect/Owner
Exit Devices	(VON) Von Duprin	As directed by Architect/Owner
Closers	(LCN) LCN	As directed by Architect/Owner
Auto Flush Bolts	(IVE) Ives	DCI
Coordinators	(IVE) Ives	DCI
Silencers	(IVE) Ives	Rockwood, Trimco
Push & Pull Plates	(IVE) Ives	Rockwood, Trimco
Kickplates	(IVE) Ives	Rockwood, Trimco
Stops & Holders	(IVE) Ives	Rockwood, Trimco
Overhead Stops	(GLY) Glynn-Johnson	ABH
Thresholds	(ZER) Zero	NGP, Pemko
Seals & Bottoms	(ZER) Zero	NGP, Pemko

2.2 HINGING METHODS:

- A. Drawings typically depict doors at 90 degrees, doors will actually swing to maximum allowable. Use wide-throw conventional or continuous hinges as needed up to 8 inches in width to allow door to stand parallel to wall for true 180-degree opening. Advise architect if 8-inch width is insufficient.
- B. Conform to manufacturer's published hinge selection standard for door dimensions, weight and frequency, and to hinge selection as scheduled. Where manufacturer's standard exceeds the scheduled product, furnish the heavier of the two choices, notify Architect of deviation from scheduled hardware.
- C. Conventional Hinges: Steel or stainless steel pins and approved bearings. Hinge open widths minimum, but of sufficient throw to permit maximum door swing.

1. Outswinging exterior doors: non-ferrous with non-removable (NRP) pins.
2. Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.

2.3 LOCKSETS, LATCHSETS, DEADBOLTS:

A. Mortise Locksets and Latchsets: as scheduled.

1. Chassis: cold-rolled steel, handing field-changeable without disassembly.
2. Universal lock case – 10 functions in one case.
3. Floating mounting tabs automatically adjusts to fit a beveled door edge.
4. Latchbolts: 0.75 inch throw stainless steel anti-friction type.
5. Lever Trim: through-bolted, accessible design, cast lever or solid extruded bar type levers as scheduled. Filled hollow tube design unacceptable.
 - a) Spindles: security design independent breakaway. Breakage of outside lever does not allow access to inside lever's hubworks to gain wrongful entry.
 - b) Inside lever applied by screwless shank mounting – no exposed trim mount screws.
 - c) Levers rotate up or down for ease of use.
 - d) Vandalgard locks: locked lever freely rotates down while remaining securely locked. This feature prevents damage to internal lock components when subjected to excessive force.
6. Furnish solid cylinder collars with wave springs. Wall of collar to cover rim of mortise cylinder.
7. Turnpieces: accessible offset turn-lever design not requiring pinching or twisting motions to operate.
8. Deadbolts: stainless steel 1-inch throw.
9. Electric operation: Manufacturer-installed continuous duty solenoid.
10. Strikes: 16 gage curved steel, bronze or brass with 1 inch deep box construction, lips of sufficient length to clear trim and protect clothing.
11. Scheduled Lock Series and Design: Schlage L series, LONA design.
12. Certifications:
 - a) ANSI A156.13, Grade 1 Operational.
 - b) ANSI/ASTM F476-84 Grade 31 UL Listed.
13. Accessibility: Require not more than 5 lb to retract the latchbolt or deadbolt, or both, per CBC 2019 11B-404.2.7 and 11B-309.4.

2.4 EXIT DEVICES / PANIC HARDWARE

A. General features:

1. Independent lab-tested 1,000,000 cycles.
2. Push-through push-pad design. No exposed push-pad fasteners, no exposed cavities when operated. Return stroke fluid dampeners and rubber bottoming dampeners, plus anti-rattle devices.
3. Deadlocking latchbolts, 0.75 inch projection.
4. End caps: impact-resistant, flush-mounted. No raised edges or lips to catch carts or other equipment.

5. No exposed screws to show through glass doors.
6. Non-handed basic device design with center case interchangeable with all functions, no extra parts required to effect change of function.
7. Releasable in normal operation with 15-pound maximum operating force per UBC Standard 10-4, and with 32-pound maximum pressure under 250-pound load to the door.
8. Exterior doors scheduled with XP-series devices: Static load force resistance of at least 2000 pounds.
9. Accessibility: Require not more than 5 lb to retract the latchbolt, per CBC 2019 11B-404.2.7 and 11B-309.4.
 - a) Mechanical method: Von Duprin "AX-" feature, where touchpad directly retracts the latchbolt with 5 lb or less of force. Provide testing lab certification confirming that the mechanical device is independent third-party tested to meet this 5 lb requirement.
 - b) Electrical method: Von Duprin's "RX-QEL-", where lightly pressing the touchpad with 5 lb or less of force closes an electric switch, activating quiet electric latch retraction.

B. Specific features:

1. Non-Fire Rated Devices: cylinder dogging.
2. Lever Trim: breakaway type, forged brass or bronze escutcheon min. 0.130 inch thickness, compression spring drive, match lockset lever design.
3. Rod and latch guards with sloped full-width kickplates for doors fitted with surface vertical rod devices with bottom latches.
4. Fire-Labeled Devices: UL label indicating "Fire Exit Hardware". Vertical rod devices less bottom rod (LBR) unless otherwise scheduled.
5. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key. Furnish storage brackets for securely stowing the mullion away from the door when removed.
6. Accepted substitutions: None, as directed by the Architect/Owner.

2.5 CLOSERS

C. Surface Closers: 4041XP

1. Full rack-and-pinion type cylinder with removable non-ferrous cover and cast iron body. Double heat-treated pinion shaft, single piece forged piston, chrome-silicon steel spring.
2. ISO 2000 certified. Units stamped with date-of-manufacture code.
3. Independent lab-tested 10,000,000 cycles.
4. Non-sized, non-handed, and adjustable. Place closer inside building, stairs, and rooms.
5. Plates, brackets and special templating when needed for interface with particular header, door and wall conditions and neighboring hardware.
6. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors. As allowed per 2016 California Building Code Section 11B-404.2.9, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15-pounds.

- a) Exception: exterior doors' pressure-to-open may be increased to 8.5-pounds if: at a single location, and one of a bank of eight leafs or fraction of eight, and one leaf of this bank is fitted with a low- or high-energy operator.
- 7. Separate adjusting valves for closing speed, latching speed and backcheck, fourth valve for delayed action where scheduled.
- 8. Extra-duty arms (EDA) at exterior doors scheduled with parallel arm units.
- 9. Exterior door closers: tested to 100 hours of ASTM B117 salt spray test, furnish data on request.
- 10. Exterior doors: seasonal adjustments not required for temperatures from 120 degrees F to -30 degrees F, furnish checking fluid data on request.
- 11. Non-flaming fluid, will not fuel door or floor covering fires.
- 12. Pressure Relief Valves (PRV) not permitted.
- 13. Accepted substitutions: None, as directed by Architect/Owner.

2.6 OTHER HARDWARE

- A. Automatic Flush Bolts: Low operating force design.
- B. Overhead Stops: Non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.
- C. Kick Plates: Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.
- D. Door Stops: Provide stops to protect walls, casework or other hardware.
 - 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. Locate overhead stops for maximum possible opening. Consult with Owner for furniture locations. Minimum: 90deg stop / 95deg deadstop. Note degree of opening in submittal.
- E. Seals: Four-fingered type at head & jambs. Inelastic, rigid back, not subject to stretching. Self-compensating for warp, thermal bow, door settling, and out-of-plumb. Adhesive warranted for life of installation.
 - 1. Proposed substitutions: submit for approval.
 - 2. Three-fingered type at hinge jambs of doors fitted with continuous hinges where jamb leaf of hinge is fastened to the frame reveal.
- F. Thresholds: As scheduled and per details. Comply with CBC 2019 11B-404.2.5. Substitute products: certify that the products equal or exceed specified material's thickness. Proposed substitutions: submit for approval.
 - 1. Saddle thresholds: 0.125 inches minimum thickness.
 - 2. Exteriors: Seal perimeter to exclude water and vermin. Use sealant complying with requirements in Division 7 "Thermal and Moisture Protection". Minimum 0.25 inch diameter fasteners and lead expansion shield anchors, or Red-Head #SFS-1420 (or approved equivalent) Flat Head Sleeve Anchors. National Guard Products' "COMBO" or Pemko Manufacturing's "FHSL".

3. Fire-rated openings, 90-minutes or less duration: use thresholds to interrupt floor covering material under the door where that material has a critical radiant flux value less than 0.22 watts per square centimeter, per NFPA 253. Use threshold unit as scheduled. If none scheduled, include a 0.25in high 5in wide saddle in the bid, and request direction from Architect.
 4. Fire-rated openings, 3-hour duration: Thresholds, where scheduled, to extend full jamb depth.
 5. Acoustic openings: Set units in full bed of Division-7-compliant, leave no air space between threshold and substrate.
 6. Plastic plugs with wood or sheet metal screws are not an acceptable substitute for specified fastening methods.
 7. Fasteners: Generally, exposed screws to be Phillips or Robertson drive. Pinned TORX drive at high security areas. Flat head sleeve anchors (FHSL) may be slotted drive. Sheet metal and wood screws: full-thread. Sleeve nuts: full length to prevent door compression.
- G. Through-bolts: Do not use. Coordinate with wood doors; ensure provision of proper blocking to support wood screws for mounting panic hardware and door closers. Coordinate with metal doors and frames; ensure provision of proper reinforcement to support machine screws for mounting panic hardware and door closers.
1. Exception: surface-mounted overhead stops, holders, and friction stays.
- H. Silencers: Interior hollow metal frames, 3 for single doors, 4 for pairs of doors. Leave no unfilled/uncovered pre-punched silencer holes. Intent: door bears against silencers, seals make minimal contact with minimal compression – only enough to effect a seal.

2.7 FINISH:

- A. Generally: BHMA 626 Satin Chromium and Matte Black 622.
 1. Areas using BHMA 626: furnish push-plates, pulls and protection plates of BHMA 630, Satin Stainless Steel, unless otherwise scheduled.
- B. Door closers: factory powder coated to match other hardware, unless otherwise noted.

2.8 KEYING REQUIREMENTS:

- A. Key System: Verify with Owner. Schlage keyway, interchangeable core. For estimate use factory GMK charge. Initiate and conduct meeting(s) with Owner and Supplier representatives to determine system requirements and keybow styles. Furnish Owner's written approval of the system; do not order keys or cylinders without written confirmation of actual requirements from the Owner. Owner will receive permanent cores. Contractor will install permanent cores.
- B. Keys
 1. Existing factory registered master key system.
 2. Construction keying: furnish temporary keyed-alike cores. Remove at substantial completion and install permanent cores in Owner's presence. Demonstrate that construction key no longer operates.
 3. Furnish 10 construction keys.
 4. Furnish 2 Emergency keys per each L9485 Faculty Restroom Lock.
 5. Furnish 2 construction control keys.

- C. Key Cylinders: furnish 6-pin solid brass construction.
- D. Cylinder cores: furnish keyed at factory of lock manufacturer where permanent records are maintained. Locks and cylinders same manufacturer.
- E. Permanent keys: use secured shipment direct from point of origination to Owner.
 - 1. For estimate: 3 keys per change combination, 5 master keys per group, 5 grand-master keys, 3 control keys.
 - 2. For estimate: VKC stamping plus "DO NOT DUPLICATE".
- F. Bitting List: use secured shipment direct from point of origination to Owner upon completion.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS:

- A. Can read and understand manufacturers' templates, suppliers' hardware schedule and printed installation instructions. Can readily distinguish drywall screws from manufacturers' furnished fasteners. Available to meet with manufacturers' representatives and related trades to discuss installation of hardware.

3.2 PREPARATION:

- A. Ensure that walls and frames are square and plumb before hardware installation. Make corrections before commencing hardware installation. Installation denotes acceptance of wall/frame condition.
- A. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.
 - 1. Notify Architect of code conflicts before ordering material.
 - 1. Locate latching hardware between 34 inches to 44 inches above the finished floor, per California Building Code, Section 1010.1.9.2 and 11B-404.2.7.
 - 2. Locate panic hardware between 36 inches to 44 inches above the finished floor.
 - 3. Where new hardware is to be installed near existing doors/hardware scheduled to remain, match locations of existing hardware.
- B. Overhead stops: before installing, determine proposed locations of furniture items, fixtures, and other items to be protected by the overhead stop's action.
- C. Existing frames and doors to be retrofitted with new hardware:
 - 1. Field-verify conditions and dimensions prior to ordering hardware. Fill existing hardware cut outs not being reused by the new hardware. Remove existing hardware not being reused, return to Owner unless directed otherwise.
 - 2. Remove existing floor closers not scheduled for reuse, fill cavities with non-shrinking concrete and finish smooth.
 - 3. Cut and weld existing steel frames currently prepared with 2.25 inch height strikes. Cut an approximate 8 inch section from the strike jamb and weld in a reinforced section to accommodate specified hardware's strike.

4. Patch and weld flush filler pieces into existing door hardware preparations in steel doors and frames, leave surfaces smooth.
5. Glue in solid wood block fillers to fill cut outs in existing wood doors, sand surfaces smooth. Alternatively, use an approved epoxy-based wood filler product, submit product data for approval.

3.3 INSTALLATION

- A. Install hardware per manufacturer's instructions and recommendations. Do not install surface-mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation. Remove and reinstall or replace work deemed defective by Architect.
 1. Gaskets: install jamb-applied gaskets before closers, overhead stops, rim strikes, etc; fasten hardware over and through these seals. Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.
 2. When hardware is to be attached to existing metal surface and insufficient reinforcement exists, use RivNuts, NutSerts or similar anchoring device for screws.
 3. Use manufacturers' fasteners furnished with hardware items, or submit Request for Substitution with Architect.
 4. Replace fasteners damaged by power-driven tools.
- B. Locate floor stops no more that 4 inches from walls and not within paths of travel. See paragraph 2.2 regarding hinge widths, door should be well clear of point of wall reveal. Point of door contact no closer to the hinge edge than half the door width. Where situation is questionable or difficult, contact Architect for direction.
- C. Core concrete for exterior door stop anchors. Set anchors in approved non-shrink grout.
- D. Locate overhead stops for minimum 90 degrees at rest and for maximum allowable degree of swing.
- E. Drill pilot holes for fasteners in wood doors and/or frames.
- F. Lubricate and adjust existing hardware scheduled to remain. Carefully remove and give to Owner items not scheduled for reuse.
- G. Field-verify existing conditions and measurements prior to ordering hardware. Fill existing hardware cut outs not being used by the new hardware.
- H. Remove existing hardware not being reused. Tag and bag removed hardware, turn over to Owner.
- I. Where existing wall conditions will not allow door to swing using the scheduled hinges, provide wide-throw hinges and if needed, extended arms on closers.
- J. Provide manufacturer's recommended brackets to accommodate the mounting of closers on doors with flush transoms.

3.4. ADJUSTING

- A. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.
 - 1. Hardware damaged by improper installation or adjustment methods: repair or replace to Owner's satisfaction.
 - 2. Adjust doors to fully latch with no more than 1 pound of pressure.
 - a) Door closer valves: turn valves clockwise until at bottom – do not force. Turn valves back out one and one-half turns and begin adjustment process from that point. Do not force valves beyond three full turns counterclockwise.
 - 3. Adjust delayed-action closers on fire-rated doors to fully close from fully-opened position in no more than 10 seconds.
 - 4. Adjust door closers per 1.9 this section.
- B. Inspection of fire door assemblies and means-of-egress panic-hardware doors: Per 2016 NFPA-80 5.2.1: hire an independent third-party inspection service to prepare a report listing these doors, and include a statement that there are zero deficiencies with the fire-rated assemblies and the openings with panic hardware.
- C. Fire-rated doors:
 - 1. Wood doors: adjust to 0.125 inches clearance at heads, jambs, and meeting stiles.
 - 2. Steel doors: adjust to 0.063 inches minimum to 0.188 inches maximum clearance at heads, jambs, and meeting stiles.
 - 3. Adjust wood and steel doors to 0.75 inches maximum clearance (undercut) above threshold or finish floor material under door.
- D. Final inspection: Installer to provide letter to Owner that upon completion installer has visited the Project and has accomplished the following:
 - 1. Has re-adjusted hardware.
 - 2. Has evaluated maintenance procedures and recommend changes or additions, and instructed Owner's personnel.
 - 3. Has identified items that have deteriorated or failed.
 - 4. Has submitted written report identifying problems.

3.5 DEMONSTRATION:

- A. Demonstrate mechanical hardware and electrical, electronic and pneumatic hardware systems, including adjustment and maintenance procedures.

3.6 PROTECTION/CLEANING:

- A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion.
- B. Clean adjacent wall, frame and door surfaces soiled from installation / reinstallation process.

3.7 SCHEDULE OF FINISH HARDWARE

- A. See door schedule in drawings for hardware set assignments.
- B. Do not order material until submittal has been reviewed, stamped, and signed by Architect's door hardware consultant.
- C. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

HEADING 01

1	PR	Door 100.1	EXTERIOR / BALLROOM
1	PR	Door 100.2	EXTERIOR / BALLROOM
1	PR	Door 100.3	EXTERIOR / BALLROOM

72.000 X 84.000 X 1.750 X EXST X EXST X --

Each Assembly to have:

Qty		Description	Catalog Number	Finish	Mfr
6	EA	HINGE	3CB1HW 4.5 X 4.5	BBLK/622	IVE
1	EA	PANIC HARDWARE	CD-3527A-EO	626	VON
1	EA	PANIC HARDWARE	CD-3527A-NL-OP-388	US19/626	VON
1	EA	RIM CYLINDER	20-057 ICX	622	SCH
2	EA	MORTISE CYLINDER	20-061 ICX XQ11-948 (DOGGING)	626	SCH
3	EA	FSIC CORE	23-030	626	SCH
2	EA	LONG DOOR PULL	9266F 48" STD	BLK	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142BK (OMIT @ OVERHANG)	BK	ZER
1	EA	SET SEAL	429AA-S (@ HEAD & JAMBS)	AA	ZER
2	EA	MEETING STILE	155BK	BK	ZER
2	EA	DOOR SWEEP	39BK	BK	ZER
2	EA	MEETING STILE	55BK	BK	ZER
1	EA	THRESHOLD	103BK-223	BK	ZER

VERIFY EXISTING CONDITIONS PRIOR TO ORDERING HARDWARE. FIELD VERIFY SPECIFIED HARDWARE WILL WORK WITH EXISTING DOOR AND FRAME PREP. MOUNT HEAD SEAL BEFORE CLOSER ARM.

HEADING 02

1 SGL Door 100.4 BALLROOM / WATER HEATER
32.000 X 84.000 X 1.750 X WD X WDF X --

Each Assembly to have:

Qty	Description	Catalog Number	Finish	Mfr
3	EA HINGE	3CB1 4.5 X 4.5	626	IVE
1	EA STOREROOM LOCK	L9080T LONA	626	SCH
1	EA FSIC CORE	23-030	626	SCH
1	EA SURFACE CLOSER	4040XP SCUSH	689	LCN
3	EA SILENCER	SR65	GRY	IVE

HEADING 03

1 SGL Door 101.1 BALLROOM / KITCHEN
42.000 X 84.000 X 1.750 X WD X WDF X --
1 SGL Door 103.1 BALLROOM / MEN'S RESTROOM
1 SGL Door 104.1 BALLROOM / WOMEN'S RESTROOM
36.000 X 84.000 X 1.750 X WD X WDF X --

Each Assembly to have:

Qty	Description	Catalog Number	Finish	Mfr
1	EA	4040XP-18TJ	689	LCN
3	EA HINGE	3CB1HW 4.5 X 4.5	626	IVE
1	EA CLASSROOM LOCK	L9070T LONA	626	SCH
1	EA FSIC CORE	23-030	626	SCH
1	EA OH STOP	100S ADJ	630	GLY
1	EA SURFACE CLOSER	4040XP ST-1630	689	LCN
3	EA SILENCER	SR65	GRY	IVE

HEADING 04

1 SGL Door 101.2 EXTERIOR / KITCHEN
36.000 X 84.000 X 1.750 X WD X WDF X --

Each Assembly to have:

Qty	Description	Catalog Number	Finish	Mfr
1	EA TOP JAMB MTG PLATE	4040XP-18TJ	693	LCN
3	EA HINGE	3CB1HW 4.5 X 4.5	626	IVE
1	EA CLASSROOM LOCK	L9070T LONA 622 626	622/626	SCH
1	EA FSIC CORE	23-030	626	SCH
1	EA OH STOP	100S ADJ	630	GLY
1	EA SURFACE CLOSER	4040XP ST-1630	689	LCN
1	EA RAIN DRIP	142BK (OMIT @ OVERHANG)	BK	ZER
1	EA SET SEAL	429BK-S (@ HEAD & JAMBS)	BK	ZER
1	EA DOOR SWEEP	110BK	BK	ZER
1	EA THRESHOLD	103BK-223	BK	ZER

HEADING 05

1 SGL Door 102.1 KITCHEN / STORAGE
36.000 X 84.000 X 1.750 X WD X WDF X --

Each Assembly to have:

Qty		Description	Catalog Number	Finish	Mfr
1	EA		4040XP-18TJ	689	LCN
3	EA	HINGE	3CB1 4.5 X 4.5	626	IVE
1	EA	STOREROOM LOCK	L9080T LONA	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	OH STOP	100S ADJ	630	GLY
1	EA	SURFACE CLOSER	4040XP ST-1630	689	LCN
3	EA	SILENCER	SR65	GRY	IVE

HEADING 06

1 SGL Door 105.1 WOMEN'S RESTROOM / POWDER ROOM
36.000 X 84.000 X 1.750 X WD X WDF X --

Each Assembly to have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	3CB1 4.5 X 4.5	626	IVE
1	EA	CLASSROOM LOCK	L9070T LONA	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP REG	689	LCN
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR65	GRY	IVE

HEADING 07

1 SGL Door 105.2 POWDER ROOM / STORAGE 2
36.000 X 84.000 X 1.750 X WD X WDF X --

Each Assembly to have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	3CB1 4.5 X 4.5	626	IVE
1	EA	CLASSROOM LOCK	L9070T LONA	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
3	EA	SILENCER	SR65	GRY	IVE

HEADING 08

1 PR Door 106.1 BALLROOM / STORAGE
 1 PR Door 107.1 STORAGE / BALLROOM

72.000 X 84.000 X 1.750 X WD X WDF X --

Each Assembly to have:

Qty		Description	Catalog Number	Finish	Mfr
2	EA		4040XP-18TJ	689	LCN
6	EA	HINGE	3CB1 4.5 X 4.5	626	IVE
1	EA	CLASSROOM LOCK	L9070T LONA	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	OH STOP	100S ADJ	630	GLY
2	EA	SURFACE CLOSER	4040XP REG	689	LCN
1	EA	ASTRAGAL	41AA	AA	ZER
2	EA	SILENCER	SR65	GRY	IVE

HEADING 09

1 PR Door 106.2 STORAGE / CLOSET

60.000 X 84.000 X 1.750 X WD X WDF X --

Each Assembly to have:

Qty		Description	Catalog Number	Finish	Mfr
6	EA	HINGE	3CB1 4.5 X 4.5	626	IVE
1	EA	CONST LATCHING BOLT	FB61T	630	IVE
1	EA	PASSAGE SET	L9010 LONA	626	SCH
2	EA	OH STOP	90S	630	GLY
2	EA	SILENCER	SR65	GRY	IVE

HEADING 10

(NO LONGER BEING USED)

HEADING 11

1 SGL Door 107.2 EXTERIOR / STORAGE
 36.000 X 84.000 X 1.750 X WD X WDF X --

Each Assembly to have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	3CB1HW 4.5 X 4.5	BBLK/62	IVE
				2	
1	EA	PANIC HARDWARE	CD-35A-NL-OP-388	626	VON
1	EA	RIM CYLINDER	20-057 ICX	622	SCH
1	EA	MORTISE CYLINDER	20-061 ICX XQ11-948 (DOGGING)	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
1	EA	LONG DOOR PULL	9266F 48" STD	BLK	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142BK (OMIT @ OVERHANG)	BK	ZER
1	EA	SET SEAL	429AA-S (@ HEAD & JAMBS)	AA	ZER
1	EA	DOOR SWEEP	39BK	BK	ZER
1	EA	THRESHOLD	103BK-223	BK	ZER

MOUNT HEAD SEAL BEFORE CLOSER ARM.

END OF SECTION

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Windows.
 - 2. Doors.

1.3 DEFINITIONS

- A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- C. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
- D. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

- B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
 - 1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300.

1.5 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Samples: For each glazing products, in the form of 12-inch- square Samples for glass and of 12-inch- long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
 - 1. Insulating glass for each designation indicated.
- C. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
 - 1. List by windows and door types scheduled on Drawings.
- D. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
 - 1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.
- E. Qualification Data: For installers.
- F. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.
- G. Product Test Reports: For each types of glazing products specified.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- B. Source Limitations for Glass: Obtain glazing products through one source from a single manufacturer for each glass type as practical.
- C. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.
- D. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.

1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
 - E. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
 1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
 2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
 - F. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.
 1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.
 2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.
 - G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 1. GANA Publications:
 - a. GANA's "Glazing Manual."
 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."
 - H. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
 1. Insulating Glass Certification Council.
 2. Associated Laboratories, Inc.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- 1.8 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 liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.9 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 1. Warranty Period: 10 years.
- B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 1. Warranty Period: 5 years.
- C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 1. Warranty Period: 10 years.
- D. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Glass Manufacturers: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
 1. Vitro (formerly PPG).
 2. Guardian.
 3. Pilkington.
 4. Visteon.
 5. Or equal.

2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

- B. Heat-Treated Float Glass (Safety Glass): ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.
 - 1. For uncoated glass, comply with requirements for Condition A.
 - 2. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
 - 3. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.
- C. Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum deposition process after manufacture and heat treatment (if any), and complying with other requirements specified.
- D. Insulating-Glass Units: Comply with Doors and Widows specifications to match existing as approved by Architect.

2.3 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of material complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

2.4 GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
 - 1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, 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.
- B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

2.5 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; 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; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive.

2.6 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: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.7 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze 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.
- B. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing glazing, 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 system.
 - 3. Minimum required face or 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.

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. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. 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.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. 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.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
 - 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.
- H. 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.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

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 just before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant where indicated.
- G. 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.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in 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. 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. 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. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.
- C. 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; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. 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.

END OF SECTION 088000

SECTION 092216 - NON-LOAD-BEARING STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes non-load-bearing steel framing members for the following applications:
 - 1. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Deflection track: List location of use.
- C. Certification of Materials: For steel framing materials.

1.4 QUALITY ASSURANCE

- 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 according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Construction Standards: Construction not on Drawings or referenced shall be as detailed in Technical Library by SSMA Technical Services.
- D. Deflection Limits: Maximum deflection of following at 5 psf.
 - 1. Gypsum board assemblies: L/240.
 - 2. Ceramic tile: L/360.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of non-load bearing steel framing that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: 1 year.
- B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Non-Load-Bearing Steel Framing: Subject to compliance with requirements, provide products by one of the following manufacturers.
- 1. California Expanded Metal Products Company (CEMCO).
 - 2. Clark Steel Framing Systems.
 - 3. Consolidated Systems, Inc.
 - 4. Dale/Incor.
 - 5. Dietrich Industries, Inc.
 - 6. Unimast, Inc.
 - 7. Western Metal Lath & Steel Framing Systems.
 - 8. Or equal.

2.2 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. 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, G40, hot-dip galvanized zinc coating, unless otherwise indicated.

2.3 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641, Class 1 zinc coating, soft temper, 18 gage minimum.
- B. Wire Hangers: Provide wires complying with the following requirements:
- 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106 inch (12 gage) diameter.
- C. Hanger Attachments to Concrete:
- 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
 - 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that

imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (16 gage) and minimum 1/2-inch- wide flanges.
 - 1. Depth: As indicated on Drawings, but not less than 1-1/2 inch.
- E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 1. Depth: As indicated on Drawings.
 - 2. Minimum Base Metal Thickness: As indicated on Drawings, but not less than 0.0296 thick (20 gage).
- F. Resilient Furring Channels: 1/2-inch deep members designed to reduce sound transmission.
 - 1. Leg Configuration: As indicated on Drawings.
 - 2. Minimum Base Metal Thickness: As indicated on Drawings, but not less than 0.0296 thick (20 gage).
- G. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Contract has the option of using manufactured grid suspension system for ceilings instead of above components.
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Drywall Grid Systems by Armstrong World Industries, Inc.
 - b. Drywall Grid System by Chicago Metallic Corporation.
 - c. Drywall Suspension System by USG Corporation.
 - d. Or equal.

2.4 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645; of size and properties necessary to comply with ASTM C 754 for the spacing indicated.
 - 1. Minimum Base-Metal Thickness: As indicated on Drawings.
 - 2. Depth: As indicated on Drawings
- B. Slip-Type Head Joints:
 - 1. 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.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) VertiTrack VTD by Steel Network Inc.
 - 2) Superior Flex Track System (SFT) by Superior Metal Trim.
 - 3) Sliptrack by Dietrich Industries.
 - 4) Or equal.
- C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base-Metal Thickness: As indicated on Drawings, but not less than 0.0179 inch (25 gage).

- D. Cold-Rolled Channel Bridging: 0.0538-inch (16 gage) bare-steel 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.
- E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 1. Depth: As indicated on Drawings.
 - 2. Minimum Base Metal Thickness: As indicated on Drawings, but not less than 0.0296 thick (20 gage).
- F. Resilient Furring Channels: 1/2-inch deep members designed to reduce sound transmission.
 - 1. Leg Configuration: As indicated on Drawings.
 - 2. Minimum Base Metal Thickness: As indicated on Drawings, but not less than 0.0296 thick (20 gage).
- G. Cold-Rolled Furring Channels: 0.0538-inch bare-steel thickness (16 gage), with minimum 1/2-inch- wide flanges.
 - 1. Depth: As indicated on Drawings.
 - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch (20 gage).
- H. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, thickness as indicated but not less than bare-metal thickness of 0.0179 inch (25 gage), and depth required to fit insulation thickness indicated.
 - 1. Size: As indicated on Drawings.

2.5 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.

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.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- 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 permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

- F. 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.
- 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.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install studs so flanges within framing system point in same direction.
- C. 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.
 - 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 not less than 2 studs at ends of arcs, place studs 6 inches o.c.
- D. 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.
- E. Z-Furring Members:
 - 1. Erect insulation (specified in Division 7 Section "Building Insulation") vertically and hold in place with Z-furring members spaced 24 inches o.c.

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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.
- F. 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.

END OF SECTION 092216

SECTION 092400 - PORTLAND CEMENT PLASTERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Patch and repair.
 - 2. Exterior three-coat portland cement plasterwork (stucco) on metal lath system.
 - 3. Integral colored finish coat and field painted.
- B. Related Sections include the following:
 - 1. Division 6 Section "Sheathing" for sheathing and weather-resistant barrier.
 - 2. Division 7 Section "Building Insulation" for thermal insulations included in portland cement plaster assemblies.
 - 3. Division 7 Section "Joint Sealants" for acoustical sealants and sealants installed with exterior portland cement plaster (stucco).
 - 4. Division 9 Section "Painting" for field painting of plaster.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 - 1. Showing details of construction for framing, reinforcement, and trims; including locations where each type material, mix, coating thickness, material sizes and thicknesses, and fastenings will be used.
 - 2. Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.
 - 3. Include details of penetration and termination, flashing details, joint locations and configurations, fastening and anchorage details including mechanical fasteners, and connections to other work.
 - 4. Show locations and extent of weather-barrier (building paper and flashing sheet). Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - a. Include details of interfaces with other materials that form part of weather barrier.
 - b. Include details of mockups.
- C. Coordination Drawings:
 - 1. Comprehensive, completely integrated set of plans, sections, elevations, and details, drawn to scale, of separate trades work, indicating interface support/connections, and

relationships between materials, and products, on which the following items are shown and coordinated with each other, based on input from fabricators and installers of the items involved:

- a. Framing, including backing, blocking, strapping, and similar accessory/sub-framing materials.
 - b. Sheathing, including building paper.
 - c. Portland cement plaster, including trim and self-adhering flashing sheet.
 - d. Other materials and products that occur in, on, adjacent to, or contiguous with above work.
2. At a minimum, indicate the following
- a. Locations/spacing of plaster trim moldings.
 - b. Locations/dimensions of self-adhering flashing sheet (underlying trim moldings).
 - c. Locations/spacings of connections/fastenings of:
 - 1) Sheathing
 - 2) Metal lath.
 - 3) Plaster trim moldings
 - d. Sequence of installation of:
 - 1) Building paper.
 - 2) Flexible flashing.
 - 3) Metal lath, and plaster trim moldings.
- D. Samples for Initial Selection: For each type of factory-prepared finish coat indicated with texture and color.
- E. Samples for Verification: For each type of factory-prepared finish coat indicated; 12 by 12 inches, and prepared on rigid backing with color selected.

1.4 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.6 PROJECT CONDITIONS

- A. Comply with ASTM C 926 requirements and Chapter 25 of the 2019 CBC.
- B. Exterior Plasterwork:
1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
 2. Apply plaster when ambient temperature is greater than 40 deg F.
 3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

- C. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cement plaster system that fail in materials within specified warranty period. Failure includes, but is not limited to, blistering, peeling, flaking, delaminating, rusting, checking, crazing, fading beyond manufacturer's published limits, or chipping as a result of manufacturing defects.
 - 1. Warranty Period: 3 years.
- B. Special Waterproof Warranty: Submit cement plaster system manufacturer's warranty certifying that work of this Section has been properly applied in strict accordance with system manufacturer's recommended procedures, instructions, and systems current applicable specifications; has been properly integrated into building construction in accordance with sound design and building construction practices; and will remain resistant to water penetration for specified warranty period.
 - 1. Warranty Period: 3 years.
- C. Weather Resistive Barriers: 10 years.
- D. Installer's Warranty:
 - 1. Warranty Period: 2 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Plaster System: Subject to compliance with requirements, provide products by one of the following manufacturers.
 - 1. LaHabra Stucco.
 - 2. Omega.
 - 3. Merlex.
 - 4. Sto.
 - 5. Or equal.
- B. Metal Lath: Subject to compliance with requirements, provide products by one of the following manufacturers.
 - 1. Clark Western Metal Lath & Steel Framing Systems.
 - 2. Alabama Metal Industries Corporation (AMICO).
 - 3. California Expanded Metal Products Company (CEMCO).
 - 4. Dale/Incor.
 - 5. Unimast, Inc.
 - 6. Structa Wire Corp.
 - 7. Or equal.

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- A. Weather-Resistant Barrier: Subject to compliance with requirements, provide products by one of the following manufacturers.
 - 1. HydroTex by Fortifiber.(Basis of Design)
 - 2. GMC Roofing.
 - 3. Or equal.

- B. Zinc-Coated (Galvanized) Steel Accessories: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
 - 1. Stockton Products. (Basis of Design)
 - 2. Fry Reglet Corp.
 - 3. Alabama Metal Industries Corporation (AMICO).
 - 4. California Expanded Metal Products Company (CEMCO).
 - 5. Dietrich Industries, Inc.
 - 6. Brand X Metals.
 - 7. Or equal.

- C. Aluminum Trim and Reveals: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
 - 1. Fry Reglet Corp. (Basis of Design)
 - 2. Flannery, Inc.
 - 3. Gordon, Inc.
 - 4. Pittcon Industries.
 - 5. Brand X Metals, Inc.
 - 6. Or equal.

2.2 MATERIALS

- A. Stucco Materials:
 - 1. Scratch & Brown (3/4"):
 - a. Scratch & Brown Concentrate: A factory blended portland cement, fibers, hydrated lime and proprietary ingredients, cement scratch and brown coat mixed in the field with sand, conforming to ASTM C926.

- B. Leveling and Reinforcing Coat:
 - 1. Stucco Level Coat: Copolymer based, factory blend of cement and proprietary ingredients requiring addition of water.
 - 2. Reinforcing mesh.

- C. Finish:
 - 1. Exterior Stucco Color Coat: blend of portland cement, hydrated lime, aggregates and additives available in 16/20 and 20/30 aggregates.
 - 2. Finish Texture and Color: Match existing as approved by Architect.

2.3 METAL LATH

- A. Expanded-Metal Lath: ASTM C 847 with ASTM A 653, G60, hot-dip galvanized zinc coating.
 - 1. Diamond-Mesh Lath: Self-furring.
 - a. Weight: 3.4 lb/sq. yd.

- b. Use: Vertical and horizontal solid support surfaces, such as unit masonry, concrete, or sheathing. Horizontal open framing up to 16 inches on center.
2. Diamond-Mesh Lath: Non-self-furring.
 - a. Weight: 3.4 lb/sq. yd.
 - b. Use: Attached with fastener when enforcing authority prohibit use of self-furring types.
3. 3/8-Inch Rib Lath (High Rib):
 - a. Weight: 3.4 lb/sq. yd.
 - b. Use: Horizontal open framing 24 inches on center.

2.4 WEATHER-RESISTANT BARRIER

- A. Super Jumbo Tex 60 Minute asphalt-saturated kraft paper with a drainable polymeric housewrap layer – packaged in a single roll. Exceeds Grade D paper performance.

2.5 ACCESSORIES

- A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
- B. Zinc-Coated (Galvanized) Steel Accessories: Fabricated from hot-dip galvanized steel sheet, ASTM A 653 G90 zinc coating.
 1. Foundation Weep Screed.
 2. Cornerite: Fabricated.
 3. External-Corner Reinforcement.
 4. Cornerbeads.
 - a. Small nose cornerbead with expanded flanges; use unless otherwise indicated.
 - b. Small nose cornerbead with perforated flanges; use on curved corners.
 - c. Small nose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing masonry corners.
 - d. Bull nose cornerbead, radius 3/4 inch minimum, with expanded flanges; use at locations indicated on Drawings.
 5. Casing Beads: Square-edged style; with expanded flanges.
 6. Control Joints: One-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 7. Expansion Joints: Folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
 - a. Internal Corners: Double-V, narrow reveal type ("No. 30").
 8. Two-Piece Expansion Joints: Formed to produce slip-joint and square-edged reveal that is adjustable from 1/4-to-5/8-inch wide; with perforated flanges.
 9. Stucco Reglet:
 - a. Product: "ST" Stucco Reglet by Fry Reglet.
 - b. Thickness: 24 gage.
 10. Surface Mounted Reglet:
 - a. Product: "SM" Surface Mount Reglet by Fry Reglet.
 - b. Thickness: 24 gage.
 11. Flashing System:
 - a. Product: Springlok Flashing System by Fry Reglet.

- b. Thickness: 24 gage.
- 12. Termination Screed: J Mold.
 - a. Product: J-B Bead by Stockton Products.
 - b. Size: As indicated on Drawings.
- 13. Window /Door Drip: Door Drip Screed.
 - a. Product: WTP Window Termination Point by Stockton Products.
 - b. Size: As indicated on Drawings.
- 14. Drip Screed: Stucco Drip Soffit.
 - a. Product: NFD #5 Drip by Stockton Products.
 - b. Size: As indicated on Drawings.

C. Aluminum Trim and Reveals:

- 1. Aluminum shall be extruded alloy 6063 T5, with clear anodized finish.
 - a. Size: As indicated on Drawings.

2.6 MISCELLANEOUS MATERIALS

- A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
- B. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063 and CBC Section 2507.
 - 1. Nails, screws, and staples as specified in CBC.
 - a. Nails: For attaching metal plaster bases to wood supports, 0.1205 inch 11 gauge diameter, 7/16 inch head, barbed, galvanized roofing nails or galvanized common nails. Nails for attaching metal plaster bases to solid substrates shall be not less than 3/4 inch long.
 - b. Screws: For attaching metal plaster base shall be fabricated in accordance with either Specification ASTM C 954 or ASTM C 1002 and shall have a 7/16 inch diameter pan wafer head and a 0.120 inch diameter shank. Screws used for attachment to metal framing members shall be self-drilling and self-tapping. Screws used for attachment to wood framing members shall be sharp-point.
 - 2. Fastener for use with concrete/masonry for attaching lath and screeds/control joints, weeps and other shapes.
 - 3. Steel Stud Applications: Galvanized steel furring nails and or screws, of type and length.
 - a. At least 2/3 inch penetration of the steel stud system.
 - 4. Wood Stud Applications: Galvanized steel furring nails and or screws, of type and length.
 - a. At least a 3/4 inch penetration of the vertical wood stud system.
 - b. At least a 1-1/2 inch penetration of the horizontal wood members.
- C. Thermal Insulation: Comply with requirements of Division 7 Section "Building Insulation".
- D. Acoustical Sealant for Exposed and Concealed Joints: Comply with requirements of Division 7 Section "Joint Sealants".

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.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
- B. Prepare solid-plaster bases that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

3.3 INSTALLATION, GENERAL

- A. Thermal Insulation: As specified in Division 7 Section "Building Insulation".
- B. Sound Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.
- C. Acoustical Sealant: Where required, seal joints between edges of plasterwork and abutting construction with acoustical sealant.

3.4 INSTALLING METAL LATH AND WEATHER-RESISTANT BARRIER INSTALLATION

- A. Comply with CBC 2507.3 Lath attachment to horizontal wood supports (DSA-SS, DSA-SS/CC).
 - 1. Where interior or exterior lath is attached to horizontal wood supports, either of the following attachments shall be used in addition to the methods of attachment described in referenced standards listed in Table 2507.2.
 - a. Secure lath to alternate supports with ties consisting of a double strand of No. 18 W & M gage galvanized annealed wire at one edge of each sheet of lath. Wire ties shall be installed not less than 3 inches back from the edge of each sheet and shall be looped around stripping, or attached to an 8d common wire nail driven into each side of the joist 2 inches above the bottom of the joist or to each end of a 16d common wire nail driven horizontally through the joist 2 inches above the bottom of the joist and the end of the wire secured together with three twists of wire.
 - b. Secure lath to each support with 1/2 inch wide, 1-1/2 inch long No. 9 W & M gage, ring shank, hook staple placed around a 10d common nail laid flat under the surface of the lath not more than 3 inches from edge of each sheet. Such staples may be placed over ribs of 3/8 inch rib lath or over back wire of welded wire fabric or other approved lath, omitting the 10d nails.
- B. General: Comply with requirements of Title 24.

1. Use of self-furring lath is subject to satisfactory jobsite demonstration for each project of lath installation, with approval by Inspector of Record.
- C. Expanded-Metal Lath: Install according to ASTM C 1063.
1. Lath shall be attached to framing members at spacing of not more than 6 inches o.c., 2 inches maximum from longitudinal edges, in accordance with CBC.
 2. Lath shall not be continuous through control joints but shall be stopped and tied at each side per ASTM C1063, 7.10.1.4.
- D. Weather-Resistant Barrier: Install 2 layers in addition to weather-resistive barrier specified in Division 6 Section "Sheathing".

3.5 INSTALLING ACCESSORIES

- A. Install according to ASTM C 1063 and at locations indicated on Drawings.
- B. Reinforcement for External Corners:
1. Install lath-type external-corner reinforcement at exterior locations.
- C. Weep screed: Install at foundation plate line on all exterior stud walls per CBC.
1. Minimum 4 inches above earth.
 2. Minimum 2 inches above paved areas.
- D. Control Joints: Install control joints in specific locations approved by Architect for visual effect as follows:
1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
 - a. Vertical Surfaces: 144 sq. ft.
 - b. Horizontal and other Nonvertical Surfaces: 100 sq. ft.
 2. At distances between control joints of not greater than 18 feet o.c.
 3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
 4. Where control joints occur in surface of construction directly behind plaster.
 5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.6 PLASTER APPLICATION

- A. General: Comply with ASTM C 926.
1. Do not deviate more than plus or minus 1/4 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.
 2. Grout hollow-metal frames, bases, and similar work occurring in plastered areas, with base-coat plaster material, before lathing where necessary. Except where full grouting is indicated or required for fire-resistance rating, grout at least 6 inches at each jamb anchor.
 3. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground, unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
 4. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

- B. Three-Coat System: Total minimum thickness of 7/8 inch for lathing base per CBC Table 2507.2.
 - 1. Scratch Coat:
 - a. Over Lathing Base: Apply scratch coat to a minimum thickness of 3/8 inch on vertical surface, and 1/4 inch on horizontal surface, using sufficient trowel pressure to key plaster into lath or to create bond to substrates as applicable. Prior to initial set, scratch horizontally to provide key for bond of brown coat.
 - 2. Brown Coat: Apply brown coat to a minimum thickness of 3/8 inch on vertical surface, and 1/4 inch on horizontal surface, using sufficient trowel pressure to insure tight contact with scratch coat.
 - a. Rod surface to screeds creating true and even plane.
 - b. Trowel to a sand float finish and uniform surface to receive finish coat.
 - c. Tool brown coat to provide a V-joint at intersection of plaster with frames or other item of wood, or metal.
 - 3. Leveling and Reinforcing Coat:
 - a. Allow Scratch & Brown Stucco Base to set and moist cure a minimum of 48 hours and allow to dry before applying the leveling and reinforcing coat.
 - b. Using a stainless steel trowel, apply the Stucco Level Coat over Stucco Base at a thickness of 1/16 – 3/32 in.
 - c. Fully embed the reinforcing mesh into the wet Stucco Level Coat including diagonal strips at corners of openings and trowel smooth. If Standard Mesh is used, seams are overlapped 2-½ in, and if the Intermediate Mesh is used, seams are butted and covered by strips of Detail mesh.
 - 4. Cement Finish Coat:
 - a. Apply Stucco Finish according to product datasheet and application instructions.
 - b. Protect Finish Coats from inclement weather until completely dry and cured.
- C. Curing Time: Comply with CBC, or longer as needed to insure compliance with manufacturer's recommendations for quality stucco installation.
 - 1. Portland cement plaster:
 - a. Minimum period moist curing:
 - 1) First Coat: 48 hours.
 - 2) Second Coat: 48 hours.
 - b. Minimum interval between coats:
 - 1) First Coat: 48 hours.
 - 2) Second Coat: 7 days.

3.7 ASSEMBLY

- A. Exterior Side from framing out:
 - 1. Sheathing.
 - 2. Weather-Resistive Barriers.
 - 3. Metal Lath.
 - 4. Portland cement plaster system.

3.8 CUTTING AND PATCHING

- A. Cut, patch, replace, and repair plaster as necessary to accommodate other work and to restore cracks, dents, and imperfections. Repair or replace work to eliminate blisters, buckles, crazing

and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.9 CLEANING AND PROTECTION

- A. Remove temporary protection and enclosure of other work. Promptly remove plaster from doorframes, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 092400

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Interior gypsum board.
- B. Related Sections include the following:
 - 1. Division 9 Section "Tiling" for cementitious backer board installed as substrates for ceramic tile.
 - 2. Division 9 Section "Painting" for primers and finishes applied to gypsum board surfaces.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
 - 2. Finishes: Level 4 and 5 of gypsum board finish indicated for use in exposed locations. 4 by 4 foot sample.
 - a. Finishes: For each finish indicated and on same backing indicated for Work.

1.4 QUALITY ASSURANCE

- 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 acceptable to OSHPD.
- B. OSHPD Regulatory Requirements: Comply with 2007 CBC, Section 2508.
- C. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.5 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.6 PROJECT 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 interior products 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.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of gypsum board that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 1 year.
- B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Interior Gypsum Board: Subject to compliance with requirements, provide products by one of the following:
 - 1. USG Corporation.
 - 2. National Gypsum Company.
 - 3. G-P Gypsum.
 - 4. Or equal.
- B. Noise Reducing Gypsum Board: Subject to compliance with requirements, provide products by one of the following:
 - 1. QuietRock. (Basis of Design)
 - 2. GypSorb.
 - 3. Or equal.
- C. Steel Trim Accessories: Subject to compliance with requirements, provide products by one of the following:

1. USG Corporation.
2. Amico.
3. Or equal.

D. Aluminum Trim: Subject to compliance with requirements, provide products by one of the following:

1. Fry Reglet Corp.
2. Gordon, Inc.
3. Pittcon Industries.
4. Or equal.

2.2 PANELS, GENERAL

A. Size: Provide in 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. General: Complying with ASTM C 36 or ASTM C 1396, as applicable to type of gypsum board indicated and whichever is more stringent.

B. Type X:

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. Water-Resistant Gypsum Backing Board: ASTM C 630 or ASTM C 1396.

1. Core: 5/8 inch, Type X.
2. Use: Toilet rooms and janitor's closets walls with painted finish.
3. Products:
 - a. USG Mold Tough Firecode Core Gypsum Panels by USG.
 - b. Gold Bond Brand Moisture-Resistant Fire Resistant Gypsum Board by National Gypsum.
 - c. Or equal.
4. When Water-Resistant Gypsum Backing Boards are not available (gradual phasing out by manufacturers), provide Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
 - a. USG Mold Tough Firecode Core Gypsum Panels by USG.
 - b. XP Wallboard by National Gypsum.
 - c. DensArmor Interior Guard by G-P.
 - d. Or equal.

D. Noise Reducing Gypsum Board:

1. Product: Model 525 by QuietRock.
2. Type and thickness: Type X fire-rated, 5/8 inch thick.
3. Configuration: Multi-layer application (staggered joints).
4. Weight: 2.7 lbs/sq ft.
5. STC-rated: Between 51 to 72 depending on assembly per ASTM E90.
6. Surface Flame: Class A per ASTM E84.
7. R value: 0.5

8. UL-rated assemblies: U386, W317.

2.4 TRIM ACCESSORIES

- A. Trim: ASTM C 1047.
 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 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. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
 2. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475.
- B. Joint Tape: Paper.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
- C. Acoustical Sealant: Comply with Division 7 Section "Joint Sealants".
- D. Thermal and Acoustical Insulation: As specified in Division 7 Section "Building Insulation."
- E. Gypsum Board Adhesives: High performance latex-based construction adhesive designed for gypsum board applications.
 1. Green Series SW-325 Shear & Drywall Adhesive by OSI.
 2. Drywall Adhesive GDWA by Grabberman.
 3. Or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, 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. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber,

including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.

3.3 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- 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. LC-Bead: Use at exposed panel edges.
 - 3. L-Bead: Use where indicated.
 - 4. U-Bead: Use at exposed panel edges.
 - 5. Curved-Edge Cornerbead: Use at curved openings.
- D. Aluminum Trim: Install in locations indicated on Drawings Insert requirements.

3.4 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 and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Comply with GA 214 for Level definitions.
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for ceramic tile or acoustical tile.
 - 3. Level 3: Where indicated on Drawings.
 - 4. Level 4: At panel surfaces that will be exposed to view with flat paint finish.
 - a. Primer and its application to surfaces are specified in other Division 9 Sections.
 - 5. Level 5: At panel surfaces that will be exposed to view with non-flat paint finish.
 - a. Primer and its application to surfaces are specified in other Division 9 Sections.

3.5 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, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

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2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093000 - TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Tile.
 - 2. Waterproof membrane for tile installations.
 - 3. Cementitious backer units installed as part of tile installations.
 - 4. Stone thresholds installed as part of tile installations.
- B. Related Sections include the following:
 - 1. Division 9 Section "Gypsum Board" for moisture resistant gypsum board.

1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
 - 1. Propose locations of expansion, contraction, control, and isolation joints if not indicated on Drawings.
- C. Installation Method: Show TCA installation method number for each tiled area in tabulated form.

- D. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.
- E. Product Certificates: For each type of product, signed by product manufacturer.
- F. Qualification Data: For Installer.
- G. Material Test Reports: For each tile-setting and -grouting product.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.
 - 1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of ceramic tile and accessories that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 1 year.
- B. Installer's Warranty: 1 year.

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.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Tile: Subject to compliance with requirements, provide products by one of the following manufacturers.
 - 1. Porcelanosa. (Basis of Design)
 - 2. Ann Sacks. (Basis of Design)
 - 3. Crossville Ceramics Company, L.P.
 - 4. Daltile; Div. of Dal-Tile International Inc.
 - 5. American Olean; Div. of Dal-Tile International Corp.
 - 6. Interceramic.
 - 7. Or equal.
- B. Setting, Grouting, and Waterproofing Materials: Subject to compliance with requirements, provide products by one of the following manufacturers.
 - 1. Custom Building Products.
 - 2. LATICRETE International Inc.
 - 3. MAPEI Corporation.
 - 4. Or equal.
- C. Sheet Waterproofing for Tile Installation: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
 - 1. Noble Company (The); Nobleseal TS.
 - 2. Schluter; KERDI.
 - 3. Or equal.
- D. Fluid Applied Waterproofing and Crack Suppression for Tile Installation: Subject to compliance with requirements, provide products by one of the following manufacturers.
 - 1. MAPEI Corporation; Mapelastic 315.
 - 2. Custom Building Products; RedGard.
 - 3. LATICRETE International Inc.; Laticrete 9235 Waterproof Membrane.
 - 4. Or equal.
- E. Cementitious Backer Board: Subject to compliance with requirements, provide products by one of the following manufacturers.
 - 1. USG Corporation; DUROCK Cement Board.
 - 2. National Gypsum Company; PermaBase.
 - 3. C-Cure; C-Cure Board 990.
 - 4. Custom Building Products; Wonderboard.
 - 5. Or equal.

- F. Metal Edge Strips: Subject to compliance with requirements, provide products by one of the following manufacturers.
 - 1. Schluter Systems (Basis of Design).
 - 2. Blanke.
 - 3. Or equal.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.
- C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
- D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

2.3 TILE PRODUCTS

- A. As indicated on Drawings.

2.4 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
- B. Marble Thresholds: ASTM C 503 with a minimum abrasion resistance of 10 per ASTM C 1353 or ASTM C 241 and with honed finish.

2.5 SHEET WATERPROOFING FOR TILE INSTALLATIONS

- A. General: Manufacturer's standard product that complies with ANSI A118.10.
- B. Thin (1/32 inch) bonded, load bearing sheet membrane for waterproofing. Alloy made from Chlorinated Polyethylene (CPE) with nonwoven fabric laminated to both sides.
 - 1. System Performance: 1-14 "Extra Heavy Service" cycles per ASTM C627.
 - 2. Hardness: 82 shore A per ASTM D2240.
 - 3. Tensile Strength: 1600 psi per ASTM D412 Die C.
 - 4. Elongation: 44% per ASTM D412 Die C.
 - 5. Tear Strength: 400 psi per ASTM D624 Die C.
 - 6. Shear Strength: Pass per ANSI A118.10-1993.

7. Shear Strength - Water Immersion: Pass per ANSI A118.10-1993.
8. Fungus & microorganism Resistance: Pass per ANSI A118.10-1993.
9. Seam Strength: Pass per ANSI A118.10-1993.
10. Waterproofness: Pass per ANSI A118.10-1993.

C. Product: Ditra XL System by Schluter or equal.

1. Description: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on underside; 5/16-inch nominal thickness.
2. Accessories:
 - a. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch nominal thickness. Kerdi-Band and Kerdi-Flex by Schluter or equal.

2.6 SETTING AND GROUTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of the following:

1. Prepackaged dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive.
 - a. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.
2. Products:
 - a. MAPEI: Ultraflex 2, Walls: MAPEI Ultralite.
 - b. 254 Platinum by Laticrete.
 - c. Custom Building Products: MegaFlex.
 - d. Or equal.

B. Polymer-Modified Tile Grout: ANSI A118.7.

1. Polymer Type: Either ethylene vinyl acetate, in dry, redispersible form, prepackaged with other dry ingredients, or acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
 - a. Unsanded grout mixture for joints 1/8 inch and narrower.
 - b. Sanded grout mixture for joints 1/8 inch and wider.
2. Colors: As selected by Architect from manufacturer's full range.
3. Products:
 - a. MAPEI Ultracolor.
 - b. 1776 (liquid) Grout Admix Plus with 1500 (sanded)/1600 (un-sanded) Series (powder) Tri-Poly Fortified Grout by Laticrete.
 - c. Or equal.

2.7 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 7 Section "Joint Sealants."

1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

2.8 CEMENTITIOUS BACKER UNITS

- A. Properties:
 - 1. Aggregated portland cement board with coated glass-mesh reinforcement scrim.
 - 2. Comply with ANSI A118.9.
 - 3. Pass ASTM E136 for non-combustibility.
 - 4. Thickness: As indicated on Drawings.
 - 5. Lengths: Maximum lengths available to minimize end-to-end butt joints.

2.9 MOISTURE AND MOLD-RESISTANT GYPSUM BOARD

- A. Comply with requirements of Division 9 Section "Gypsum Board".
- B. Substrates for painted surfaces in toilet rooms. Do not use as substrate for tile application.

2.10 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications, in aluminum finishes selected by Architect.
 - 1. Outside Corners: ECK-E by Schluter or equal.
 - 2. Exposed Edges: JOLLY by Schluter or equal.
- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.11 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
 - a. Sub-floor and Vertical Surfaces: 1/4 inch in 10 feet.
 - 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
 - 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.
- B. Provide concrete substrates for tile floors installed with mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
 - 1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
 - 2. Remove protrusions, bumps, and ridges by sanding or grinding.
- C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

- D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
- F. Lay out tile wainscots to next full tile beyond dimensions indicated.
- G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Locate joints in tile surfaces directly above joints in concrete substrates.
- H. Grout tile to comply with requirements of the following tile installation standards:
 - 1. For ceramic tile grouts (polymer modified grouts), comply with ANSI A108.10.

3.4 CEMENTITIOUS BACKER UNIT INSTALLATION

- A. Install cementitious backer units and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.
- C. At showers, tubs, and where indicated, install cementitious backer units and treat joints to comply with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.5 WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.
- B. Do not install tile over waterproofing until waterproofing has been tested to determine that it is watertight.

3.6 CRACK-SUPPRESSION MEMBRANE INSTALLATION

- A. Install crack-suppression membrane to comply with manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.
- B. Do not install tile over crack-suppression membrane until waterproofing has cured and been tested to determine that it is watertight.

3.7 FLOOR TILE INSTALLATION

- A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.
- B. Joint Widths: 1/16 inch unless specified otherwise.
- C. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

3.8 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove latex-portland cement grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
- B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.9 FLOOR TILE INSTALLATION, TCA ASSEMBLY

- A. Tile Installation: Interior floor installation on waterproof membrane over concrete; thin-set mortar; TCA F122 and ANSI A108.5.
 - 1. Mortar: Latex-portland cement mortar.
 - 2. Grout: Polymer-modified sanded and polymer-modified unsanded grout.

3.10 EXTERIOR AND INTERIOR WALL TILE INSTALLATION, TCA ASSEMBLY

- A. Tile Installation: TCNA W221 and ANSI A108.1A, cement mortar bed (thickset) on metal lath over waterproof membrane.
 - 1. Bond Coat for Wet-Set Method: Improved modified dry-set mortar.
 - 2. Grout: Polymer-modified sanded and polymer-modified unsanded grout.

END OF SECTION 093000

SECTION 095000 – INTEGRATED CEILING ASSEMBLIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.2 SUMMARY

- a) Section Includes
 - 1) Acoustical ceiling panel
 - 2) Wire hangers, fasteners, main runners, cross tees, and wall angle moldings
 - 3) Perimeter Trim

- b) Related Sections
 - 1) Section 09 20 00 - Plaster and Gypsum Board
 - 2) Divisions 23 - HVAC Air Distribution
 - 3) Division 26 - Electrical

- c) Alternates
 - 1) Prior Approval: Unless otherwise provided for in the Contract documents, submit proposed product substitutions no later than TEN (10) working days prior to the date established for receipt of bids. Acceptability of a proposed substitution is contingent upon the Architect's review and acceptance. Approved products will be set forth by the Addenda. If a substitution is included in a Bid and is not approved by an Addendum, the specified products shall be provided as in place of the substitute without additional compensation.

 - 2) Submittals that do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers (if specified in Section 1.5); Underwriters' Laboratories Classified Acoustical performance; Panel design, size, composition, color, and finish; Suspension system component profiles and sizes; Compliance with the referenced standards.

1.3 REFERENCES

- a) American Society for Testing and Materials (ASTM):

- 1) ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
 - 2) ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
 - 3) ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
 - 4) ASTM C 645 Standard Specification for Metal Suspension Systems
 - 5) ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
 - 6) ASTM C754 AND C1858 All installations should be in compliance with these tests.
 - 7) ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
 - 8) ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
 - 9) ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint
 - 10) ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - 11) ASTM E 1414 Standard Test Method for Airborne Sound Attenuation between Rooms Sharing a Common Ceiling Plenum
 - 12) ASTM E 1264 Classification for Acoustical Ceiling Products
 - 13) ASTM E3090 All references to suspension component property testing per this test method.
- b) B. International Building Code
 - c) C. ASHRAE Standard 62.1-2004, Ventilation for Acceptable Indoor Air Quality
 - d) D. NFPA 70 National Electrical Code
 - e) E. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures
 - f) International Code Council-Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components
 - g) International Code Council-Evaluation Services Report - Seismic Engineer Report
 - a. 1. ESR 1289 - Armstrong Suspension Systems
 - h) California Department of Public Health CDPH/EHLB Emission Standard Method Version 1.2 2017
 - i) LEED - Leadership in Energy and Environmental Design is a set of rating systems for the design, construction, operation, and maintenance of green buildings
 - j) International Well Building Standard
 - k) Mindful Materials
 - l) Living Building Challenge

1.4 SYSTEM DESCRIPTION

Continuous/Wall-to-Wall or Cloud installation

1.5 SUBMITTALS

- a) Shop Drawings: Layout and details of ceilings. Show locations of items that are to be coordinated with, or supported by the ceilings.
- b) Installation Instructions: Submit manufacturer's installation instructions as referenced in Part three, Installation.
- c) Product Data: Submit manufacturer's technical data for each type of ceiling unit and suspension system required.
- d) Samples: Minimum 6 x 6 inch samples of specified panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees.
- e) Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.
- f) Non-Conformance: All products not conforming to the requirements of this specification and or the manufacturer's published values are to be disposed. The Contractor performing the work will replace with approved product at their expense.

1.6 SUSTAINABLE MATERIALS

- a) Transparency: Manufacturers will be given preference when they provide documentation to support sustainable requirements for the following: Material ingredient transparency, Removal of Red List Ingredients per LBCV3, Life Cycle impact information, Low-Emitting Materials, and Clean Air performance.
 - 1) Health Product Declaration. The end use product has a published, complete Health Product Declaration with disclosure at a minimum of 1000ppm of known hazards in compliance with the Health Product Declaration open Standard.
 - 2) Declare Label. The end use product has a published Declare label by the International Living Future Institute with disclosure of 100 ppm with a designation of Red List Free or Compliant (less than 1% proprietary ingredients).
 - 3) Low Emitting products with VOC emissions data. Preference will also be given to manufacturers that can provide emissions data showing their products meet CDPH Standard Method v1.2, 2017 (Section 01350).
 - 4) Life cycle analysis. Products that have communicated lifecycle data through Environmental Product Declarations (EPDs) will be preferred.
 - 5) End of Life Programs/Recycling: Where applicable, manufacturers that provide the option for recycling of their products into new products at end-of-life through take-back programs will be preferred.
 - 6) Products meeting LEED V4 requirements including:
 - a. Storage & Collection of Recyclables

- b. Construction and Demolition Waste Management Planning
- c. Building Life-Cycle Impact Reduction
- d. Building Product Disclosure and Optimization Environmental Product Declarations
- e. Building Product Disclosure and Optimization Sourcing of Raw Materials
- f. Building Product Disclosure and Optimization Material Ingredients
- g. Construction and Demolition Waste Management

1.7 QUALITY ASSURANCE

- a) Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.
- b) Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
- c) Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 Classification.
- d) Acoustical Panels: As with other architectural features located at the ceiling that may obstruct or skew the planned fire sprinkler pattern through possibly delay or accelerate the activation of the sprinkler or fire detection systems by channeling heat from a fire either toward or away from the device. Designers and installers are advised to consult a fire protection engineer, NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.
- e) Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers. ACOUSTIBuilt Panels are 7/8" thick.
- f) Installer Qualification: Subcontractor is an experienced Installer that has reviewed and understands the system installation instructions thoroughly. Subcontractor will follow written installation instructions and utilize approved equipment and procedures for finishing installation.
- g) ACOUSTIBuilt is finished to a level 4 drywall finish equivalent. Installing ACOUSTIBuilt requires special attention to finishing details. Light coves and low angle lighting will exaggerate imperfections. Mock-ups and hands-on training are strongly recommended.

1.8 DELIVERY, STORAGE AND HANDLING

- a) Deliver acoustical ceiling units to project site in original, unopened packages/crates and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- b) Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content. Store all material within temperature limits required by manufacturer.
- c) Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.9 PROJECT CONDITIONS

- a) Space Enclosure:
 - 1) Building areas to receive ceilings shall be free of construction dust and debris. ACOUSTIBuilt panels should be installed in areas where the building is enclosed and the HVAC is continuously functioning. This product is not recommended for exterior applications, where standing water is present, or where moisture will come into direct contact with the ceiling.
 - i. HVAC should be designed, installed, and operated in accordance with ASHRAE Standard 62.1. It is also necessary for the area to be enclosed, for the HVAC systems to be functioning, and in continuous operations for the life of the product. Product is not intended for use where natural ventilation is part of the ventilation strategy and not recommended in areas where a differential plenum pressure exists.

1.10 WARRANTY

- a) Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:
 - a. Acoustical Panels: Manufacturer's defects in material
 - b. Grid System: Rusting and manufacturer's defects
- b) Warranty Period:
 - a. Acoustical panels: Ten (10) years from date of substantial completion
 - b. Suspension: Ten (10) years from date of substantial completion
- c) The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

I. PART 2 - PRODUCTS

2.1 MANUFACTURERS

- a) Basis of Design ACOUSTIBuilt:
 - a. Armstrong World Industries, Inc.
- b) Finish
 - a. Joint Compound Finish by Others
 - b. Spray Applied Finish by Armstrong World Industries, Inc.
- c) Perimeter Trim Systems
 - a. Armstrong World Industries, Inc.

2.2.1 ACOUSTICAL CEILING UNITS

a) Acoustical Panels

- 1) Surface Texture: Fine
- 2) Composition: Mineral Fiber
- 3) Color: White (Fine Texture Finish for ACOUSTIBuilt panels)
Black (Fine Texture Finish for ACOUSTIBuilt panels)

Custom Colors: Available in all colors tones
- 4) Size: 48 in x 72 in x 7/8 in - Item #2604
- 5) Edge Profile: Tapered edges four sides
- 6) Noise Reduction Coefficient (NRC): ASTM C 423; Panel 0.80 (UL)
- 7) Ceiling Attenuation Class (CAC): ASTM C 1414; Panel 46 (UL), System up to 48
- 8) Sabin: Cloud Applications: 0.80 Sabins/SF & 1.33 Sabins/SF with infill item 8200T10
- 9) Flame Spread: ASTM E 1264; Class A
- 10) Light Reflectance (LR) White Panel: ASTM E 1477; 0.87
- 11) Dimensional Stability: HumiGuard Plus
- 12) Recycle Content: Post-Consumer and Pre-Consumer – up to 75%
- 13) Material Ingredient Transparency: Health Product Declaration (HPD); Declare Label
- 14) Life Cycle Assessment: Third Party Certified Environment Product Declaration (EPD)
- 15) Acceptable Product: ACOUSTIBuilt panels #2604 No added formaldehyde as manufactured by Armstrong World Industries
- 16) Contact your local Armstrong Representative for required installation training at least 4-6 weeks before ordering materials and scheduling installation.

b) Finish

1. Joint Compound

- a. Setting Compound: Lightweight setting-type drywall joint compound, Ultra lightweight drying-type drywall joint compound
- b. Joint Tape: Self-Adhesive mesh drywall joint tape (Panel to Panel)
 1. Use Setting Type Compound for initial coats and use Drying Type Compound for final coats per the installation instructions. DO NOT use any other type of drywall compound such as All-Purpose Compound.
 2. Paper tape at the wall intersection

2. Spray Applied Finish – Required Product: #2605WH or 2605BL Fine Texture Finish for ACOUSTIBuilt panels – White as manufactured by Armstrong World Industries.

For information regarding the ACOUSTIBuilt products, contact your Armstrong Sales Representative:

<https://www.armstrongceilings.com/commercial/en/rep-locator.html>

- c) Material Ingredient Transparency: Health Product Declaration (HPD); Declare Label
- d) Life Cycle Assessment: Third Party Certified Environmental Product Declaration (EPD)

II. PART 3 - EXECUTION

- a) Prior to installation, contact your Armstrong Installation Systems Specialist (ISS). Before installation, inspect previous work of all other trades. Verify that all work is complete and accurate to the point where this installation may properly proceed in strict accordance with framing shop drawings.
- b) If framing preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- c) The system installation is similar to a conventional drywall installation. However, there are key differences in both material substrate and methods of finishing and installation that make this system unique. Installers should review and follow all written directions of the installation instructions and view the installation video.
<https://www.armstrongceilings.com/commercial/en/commercial-ceilings-walls/acoustibuilt-ceiling-panels.html#!video=6034280272001>
- d) Installation: In accordance with all approved plans, details, and manufacturer's installation guidelines located in the Armstrong ACOUSTIBuilt Assembly and Installation Instructions (BPLA-299099) [Click to follow to ACOUSTIBuilt Installation Instructions](#), and Drywall Grid Systems Hanging and Framing Flat Ceilings Installation Guides (BPCS3539) [Click to follow to Hanging and Framing Flat Drywall Instructions](#).

3.2.1 PREPARATION

- a) Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.
- b) Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
- c) Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.2.3 INSTALLATION

Follow manufacturer installation instructions. Armstrong ACOUSTIBuilt Assembly and Installation Instructions (BPLA-299099) [Click to follow to ACOUSTIBuilt Installation Instructions](#) [Check](#)

- A) Control joints are required following the standards used for gypsum board listed in ASTM C840, Section 20

- I. Ceilings with perimeter relief cannot exceed 50 LF and 2500 SF between control joints
 - II. Ceilings without perimeter relief cannot exceed 30 LF and 900 SF between control joints
- B) Panel joints and fasteners are finished with tape and compound to create a flat surface. While the materials used to finish ACOUSTIBuilt panels are also used to finish drywall, the procedure has unique requirements.
- C) Joint compound coverage shall be limited to preserve the acoustical performance of the panels. Compound at panel joints shall not exceed 8 inch widths. Compound applied to field fasteners shall not exceed 2 inch by 2-inch areas. All compound shall be smooth and free of tool marks and ridges. Panels are to be finished with taping knives. Production tools, including boxes, are detailed on the installation instructions.
- D) Sanding and inspection: Throughout the sanding process, inspect the surface frequently for flatness. Direct a light across the ceiling to highlight unevenness that requires attention.
- E) Fine Texture Finish shall be applied in 4-5 coat process (additional coat may be used to achieve the desired finish) as called out in the installation instructions. Fine Texture Finish for ACOUSTIBuilt is applied in multiple coats, layered to achieve a uniform appearance and acoustical performance. It is strongly encouraged to practice spraying to ensure proper calibration and technique are achieved. Refer to the installation video.
- I. ACOUSTIBuilt fine texture finish **MUST** be sprayed with a Graco Mark V texture system. This equipment properly atomizes the finish for acoustics and aesthetics. Fine texture finish is not intended for use with any other airless paint systems not recommended by Armstrong or to be applied by brush or rolling.
 - II. See Manufactures installation instructions for correct spray tip, pressure settings for spray system, finish preparation, spray calibration and spray procedure and technique.

3.2.4 ADJUSTING AND CLEANING

- a) To remove soot, dirt, and dust use a vacuum operating at low power with a soft brush or use a dry soot cleaning sponge.
- b) Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage.

End of Section

SECTION 096516 – RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes:
 - 1. Sheet vinyl floor coverings.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each type of flooring. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 1. Show details of special patterns.
 - 2. Include concrete moisture and alkalinity limits.
- C. Samples for Initial Selection: For each type of floor covering indicated.
 - 1. Include similar Samples of installation accessories involving color selection.
- D. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch sections of each different color and pattern of floor covering required.
 - 1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.
- E. Heat-Welded Seam Samples: For each flooring product and welding bead color and pattern combination required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.
- F. Qualification Data: For Installer.
- G. Maintenance Data: For floor coverings to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project that are competent in heat-welding techniques required by manufacturer for floor covering installation.
 - 1. Engage an installer who employs workers for this Project that are trained or certified by floor covering manufacturer for heat-welding techniques required.

- B. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store floor coverings 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. Store rolls upright.

1.6 PROJECT CONDITIONS

- A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor covering installation.
- D. Close spaces to traffic for 48 hours after floor covering installation.
- E. Install floor coverings after other finishing operations, including painting, have been completed.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sheet vinyl floor coverings that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 5 years.
- B. Installer's Warranty: 1 year.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each color, pattern, and type of floor covering installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Sheet Vinyl Floor Coverings: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
1. Johnsonite. (Basis of Design)
 2. TOLI International.
 3. Altro Floors.
 4. Armstrong World Industries, Inc.
 5. Forbo Industries, Inc.
 6. Mannington Commercial.
 7. Or equal.

2.2 SHEET VINYL FLOOR COVERING

- A. Product: iQ Natural by Johnsonite or equal.
1. Material: Plasticizer based on renewable resources and the iQ construction for low maintenance.
 2. Construction: Composed of iQ technology, which is an exclusive blend of quality raw materials that provide a superior wear and abrasion resistance surface.
 3. Overall thickness: 0.080" (2.0 mm).
 4. Performance Data:
 - a. Sheet material meets ASTM F 1913 performance standards for homogeneous single layered vinyl floor covering.
 - b. Resistance to heat by color change (ASTM F 1514): $\Delta E \leq 8.0$.
 - c. Resistance to light by color change (ASTM F 1515): $\Delta E \leq 8.0$.
 - d. Electrostatic Propensity (EN 1815): < 2 kV.
 - e. Static coefficient of friction (ASTM D 2047): > 0.6 .
 - f. Static Load Limit (ASTM F 970): Passes 250 psi requirement.
 - g. Fire Performance:
 - 1) Flooring Radiant Panel: ASTM E 648 – Class 1.
 - 2) Smoke Density: ASTM E 662 Less than 450.
 5. Color: As indicated on Drawings.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by floor covering manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit sheet vinyl floor covering and substrate conditions indicated.
1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Heat-Welding Bead: Solid-strand product of floor covering manufacturer.
1. Color: As selected by Architect from manufacturer's full range.

- D. Integral-Flash-Cove-Base Accessories:
 - 1. Cove Strip: 1-inch radius provided or approved by floor covering manufacturer.
 - 2. Cap Strip: Square metal, vinyl, or rubber cap provided or approved by floor covering manufacturer.
 - 3. Corners: Metal inside and outside corners and end stops provided or approved by floor covering manufacturer.

- E. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of floor coverings, 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 installation tolerances, moisture content, and other conditions affecting performance.
 - 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 floor coverings.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of floor coverings.

- B. Concrete Substrates:
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

- C. Remove substrate coatings and other substances that are incompatible with floor covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

- D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

- E. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
 - 1. Do not install floor coverings until they are same temperature as space where they are to be installed.

- F. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Unroll sheet vinyl floor coverings and allow them to stabilize before cutting and fitting.
- B. Lay out sheet vinyl floor coverings as follows:
 - 1. Maintain uniformity of floor covering direction.
 - 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor covering substrates.
 - 3. Match edges of floor coverings for color shading at seams.
 - 4. Avoid cross seams.
- C. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.
- D. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.
- E. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.
- F. Install floor coverings on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern with pieces of floor coverings installed on covers. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.
- G. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- H. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.
- I. Integral Flash Cove Base: Cove floor coverings 6 inches up vertical surfaces. Support floor coverings at horizontal and vertical junction by cove strip. Butt at top against cap strip.
 - 1. Install metal corners at inside and outside corners.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing floor covering installation:
 - 1. Remove adhesive and other blemishes from floor covering surfaces.
 - 2. Sweep and vacuum floor coverings thoroughly.
 - 3. Damp-mop floor coverings to remove marks and soil.
 - a. Do not wash floor coverings until after time period recommended by manufacturer.
- B. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
 - 1. Apply protective floor polish to surfaces that are free from soil, visible adhesive, and blemishes if recommended in writing by manufacturer.
 - 2. Cover floor coverings with undyed, untreated building paper until Substantial Completion.

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3. Do not move heavy and sharp objects directly over floor coverings. Place plywood or hardboard panels over floor coverings and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION 096516

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Luxury Vinyl Tile (LVT).
 - 2. Resilient wall base and accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product indicated.
- C. Samples for Verification: Full-size units of each color and pattern of resilient floor tile required.
- D. Maintenance Data: For resilient products to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 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. Store tiles on flat surfaces.

1.6 PROJECT CONDITIONS

- A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.

3. 48 hours after installation.
- B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor covering installation.
- D. Close spaces to traffic for 48 hours after floor covering installation.
- E. Install resilient products after other finishing operations, including painting, have been completed.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of resilient floor tile that fails in materials or workmanship within specified warranty period.
 1. Warranty Period: 1 year.
- B. Installer's Warranty: 1 year.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Luxury Vinyl Tile (LVT): Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
 1. Milliken. (Basis of Design)
 2. Shaw Hard Surface.
 3. Armstrong World Industries, Inc.
 4. Lightwood by TOLI International.
 5. Marley Flexco (USA), Inc.
 6. Roppe Corporation.
 7. VPI, LLC, Floor Products Division.
 8. Or equal.
- B. Type TP Resilient Wall Base: Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.
 1. Flexco. (Basis of Design)
 2. Johnsonite.
 3. Burke Mercer Flooring Products.

4. Allstate Rubber.
5. Armstrong.
6. Or equal.

2.2 LUXURY VINYL TILE (LVT)

- A. Products: As indicated on Drawings.

2.3 RESILIENT WALL BASE

- A. Products: As indicated on Drawings.

2.4 MOISTURE BARRIER

- A. Suppresses extreme moisture emission levels in concrete up to 99.5% RH (Relative humidity) ASTM F2170.
- B. Protects against alkalinity and promotes flooring adhesion.
- C. Mold and fungus resistant (ASTM D3273).

2.5 INSTALLATION MATERIALS

- A. 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.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed resilient tile and as recommended/ required by the manufacturer for warrantee acceptance or provided by resilient tile manufacturer for the type of carpet being installed.
 1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. VCT and Asphalt Tile Adhesives: 50 g/L.
 - b. Cove Base Adhesives: 50 g/L.
 - c. Rubber Floor Adhesives: 60 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
 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.

2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. Concrete Substrates:
 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
- C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
 1. Do not install resilient products until they are same temperature as space where they are to be installed.
- F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 TILE INSTALLATION

- A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
- B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
- C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- D. Extend tiles into toe spaces, door reveals, closets, and similar openings.
- E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- F. Install tiles on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of tile installed on covers. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

- G. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 RESILIENT WALL BASE INSTALLATION

- A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- D. Do not stretch wall base during installation.
- E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.
- F. Premolded Corners: Install premolded corners before installing straight pieces.

3.5 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
 - a. Do not wash surfaces until after time period recommended by manufacturer.
- B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
 - 1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.
 - a. Use commercially available product acceptable to manufacturer.
 - 2. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION 096519

SECTION 099100 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Surface Preparation.
 - 2. Field application of paints, stains, varnishes, and other coatings.

1.3 SUBMITTALS

- A. Product data - Submit product data sheets for each product.
- B. Samples:
 - 1. Submit two painted samples, illustrating selected colors and textures for each color and systems selected with specified coats cascaded.
 - 2. Submit on suitable backing, 8x10 inch size.

1.4 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.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 4 by 4 feet.
 - 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 project.
 - 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.

1.5 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

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- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Provide lighting level of 80 ft candles measured mid-height at substrate surface.
- C. Environment Requirements:
 - 1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be stored and applied.
 - 2. Do not paint when there is a threat of rain within 24 hours or when surface or air temperatures are at or below 40 degrees.

1.7 WARRANTY

- A. Installer Warranty: 1 year.

1.8 EXTRA STOCK

- A. Minimum 1 gallon each product in original or new 1 gallon cans.
 - 1. Color spot each lid.
 - 2. Identify with formula, location, product and date.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Paints: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
 - 1. Benjamin Moore and Company. (Basis of Design)
 - 2. Sherwin Williams.
 - 3. PPG.
 - 4. Vista Paint.
 - 5. Or equal.

2.2 PAINTS AND COATINGS

- A. Ready mixed, except field-catalyzed coatings.
- B. Prepare pigments:
 - 1. To a soft paste consistency, capable of being readily and uniformly dispersed to a homogenous coating.

2. For good flow and brushing properties.
3. Capable of drying or curing free of streaks or sags.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application. Do not proceed unless substrate is suitable.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 1. Plaster and Gypsum Wallboard: 12 percent.
 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent
 3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.2 PREPARATION OF SURFACE

- A. General:
 1. Clean all exterior walls and surfaces of loose and scaly paint, dirt, dust, chalk, and other foreign matter by water-blasting using care not to damage substrate followed by hand scraping, sanding or wire brushing after surfaces are dry. Mildew must be treated with household bleach solution and rinsed thoroughly.
 2. Patch, caulk, set protruding nails and repair all surfaces and cracks where necessary with suitable patching materials and smooth off to match adjacent surfaces.
 3. Sand Glossy surfaces to dull surface and remove residue.
 4. Remove mildew from affected surfaces with a solution of Tri-Sodium Phosphate and bleach. Rinse with clean water and allow to dry completely.
 5. Existing surfaces to be recoated shall be thoroughly cleaned and de-glossed by sanding or other means prior to priming and painting. Patched and bare areas shall be spot primed with the same primer as specified for new work.
 6. Rusty metal: Scrape, sand or wire wheel, feathering edges to sound coating. Dust surfaces. Topcoat.
 7. Remove soil and body oils completely from surfaces, including handrails, door edges and posts. Treat with Liquid Sandpaper or Dull-N-Bond.
 8. Remove hardware, accessories, plates, fixtures and similar items not to be finished. Reinstall at completion.
 9. Paint edges of sink cut-outs.
- B. Concrete Surfaces:
 1. Concrete surfaces shall be dry, clean and free from efflorescence, encrustations and other foreign matter. Any glazed surface shall be slightly roughened or etched. Curing

compounds, bond breakers, release agents and other coatings shall be removed with a light sandblast or high pressure power wash.

- C. CMU Surfaces:
 - 1. Remove dirt, loose mortar, scale, powder and other foreign matter from concrete block surfaces which are to be painted.
 - 2. Unpainted CMU surfaces shall be cleaned with TSP. Rinse thoroughly. Surface shall be tested for adhesion. Prime as listed in materials section; allow to cure, then perform adhesion test with duct tape.
- D. Galvanized Surfaces: Remove all oils and contamination from galvanized surfaces scheduled to be painted by washing with a compliant solvent wash.
- E. Ferrous Metal: Remove grease, rust, scale, dirt and dust from ferrous metal surfaces. Primer coat shall be applied not less than 30 minutes, nor more than 3 hours after preparation of surface.
- F. Primed Metal: Sand and scrape shop primed metal to remove loose primer and rust. Touch-up bare, abraded and damaged areas with metal primer. Feather edges to make touch-up patches inconspicuous.
- G. Wood Surfaces:
 - 1. Remove dust, grit and foreign matter from wood surfaces. Sand surfaces and dust clean. Spot prime knots, pitch streaks and sappy sections with a stain blocking primer where surfaces are to be painted. Fill nail holes, cracks and other defects after priming and spot prime repairs after patching material has fully cured.
 - 2. Wood surfaces with peeling areas are to have edges of broken paint film sanded to a feather edge.
 - 3. Back prime wood trim. Paint tops, bottoms, edges and cut-outs of doors.
- H. Plaster Surfaces:
 - 1. Plaster surfaces shall be dry and free from efflorescence, encrustations and foreign matter. Fill cracks, holes and imperfections, smoothing repairs to match adjacent texture. Allow repairs to fully cure before priming.
 - 2. Prime plaster surfaces with specified primer. Caulk all cracks.
- I. Gypsum Board: Gypsum board shall be dusted clean and free from encrustations and other foreign matter.
- J. Preparation of other surfaces shall be performed following specific recommendations of the coating manufacturer.

3.3 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

- D. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless otherwise approved
- E. Sand wood surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust particles just prior to applying next coat.
- G. Stipple all edges and corners to conceal brush marks.
- H. Paint entire trim element with like color. Painting of faces only is unacceptable. Trim surfaces must be wrapped with the trim color and not "faced off" or "Hollywooded".
- I. Doors: Paint entire door unless otherwise noted, including door top and bottom edge surfaces.
- J. Tinting: Tint each primer a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint primer to match the color of the finish coat, but provide sufficient differences in shade of primer to distinguish each separate coat.

3.4 PROTECTION

- A. Protect work of other trades and items not intended to receive paint. Install "wet paint" signs to protect newly painted surfaces.

3.5 CLEANING

- A. Protection - Carefully protect areas where work is in progress from damage.
 - 1. Provide and spread clean drop cloths when and where required to provide the necessary protection.
 - 2. Immediately clean-up all accidental spatter, spillage, misplaced paint and restore the affected surface to its original condition.
- B. Clean-up:
 - 1. Clean up debris daily per OSHA requirements.
 - 2. At completion of work, remove all materials, supplies, debris and rubbish and leave each area in a clean, acceptable condition.
 - 3. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.6 SURFACES TO BE FINISHED

- A. Paint all new work and areas affected by new work, unless noted otherwise.
- B. Do not paint or finish the following items:
 - 1. Items fully factory-finished unless specifically noted.
 - 2. Fire rating labels, equipment serial number and capacity labels.
- C. Mechanical and Electrical: Use paint systems defined for the substrates to be finished.

1. Paint all insulated and exposed pipes occurring in finished areas to match background surfaces, unless otherwise indicated.
2. Paint shop primed items occurring in finished areas.
3. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint.
4. Paint dampers exposed behind louvers, grilles and convector and baseboard cabinets to match face panels.

3.7 PAINT SYSTEMS – EXTERIOR

A. Wood:

1. One coat Exterior Wood Primer: BM Sure Seal Primer Sealer #027: Applied at a dry film thickness of not less than 1.8 mils.
2. Two coats acrylic latex exterior enamel, semi-gloss: Ultra Spec EXT Satin Finish N448. Applied at a dry film thickness of not less than 1.8 mils per coat.

B. Concrete and Portland Cement Plaster:

1. One Coat Primer: Block Filler No. 206: Applied at a dry film thickness of not less than 8.1 mils or Masonry Conditioner #066. Applied at a dry film thickness of not less than 1.0 mils.
2. Two coats low lustre, exterior coating: Ultra Spec EXT Satin Finish N448. Applied at a dry film thickness of not less than 1.8 mils per coat.

C. Concrete Block:

1. Primer: Block Filler No. 206: Applied at a dry film thickness of not less than 8.1 mils or Masonry Conditioner #066. Applied at a dry film thickness of not less than 1.0 mils.
2. Two coats low lustre, exterior coating: Ultra Spec EXT Satin Finish N448. Applied at a dry film thickness of not less than 1.8 mils per coat.

D. Steel – unprimed:

1. Two Coats exterior DTM Semi-Gloss Finish: DTM Acrylic Semi-Gloss (HP29). Applied at a dry film thickness of not less than 2.0 mils per coat.

E. Steel – shop primed:

1. Touch-up with original primer.
2. Two Coats exterior DTM Semi-Gloss Finish: DTM Acrylic Semi-Gloss (HP29). Applied at a dry film thickness of not less than 2.0 mils per coat.

F. Galvanized Steel

1. Prepare with galvanizing etch.
2. Two Coats: DTM Acrylic Semi-Gloss (HP29). Applied at a dry film thickness of not less than 2.0 mils per coat.

G. Galvanized Sheet Metal:

1. Clean and etch surface.
2. One coat exterior acrylic DTM primer: Acrylic Metal Primer HP04; Applied at a dry film thickness of not less than 2.0 mils.
3. Two Coats exterior DTM Semi-Gloss Finish: DTM Acrylic Semi-Gloss (HP29). Applied at a dry film thickness of not less than 2.0 mils per coat.

- H. Aluminum – mill finish:
 - 1. Clean and etch surface.
 - 2. Two coats 100% Acrylic DTM paint, semi-gloss: DTM Acrylic Semi-Gloss (HP29). Applied at a dry film thickness of not less than 2.0 mils per coat.

3.8 PAINT SYSTEMS -INTERIOR

- A. Wood – Opaque, latex, Eggshell/Semi-Gloss, 3 coat:
 - 1. One (1) Coat – BM Sure Seal Primer Sealer #027: Applied at a dry film thickness of not less than 1.8 mils.
 - 2. Two (2) Coats – Ultra Spec 500 Interior Eggshell/Semi Gloss Finish #538/539 or Ben #W627
- B. Ferrous Metal – Latex, Semi-Gloss, 3 coat:
 - 1. One (1) Coat DTM Acrylic Metal Primer # P04.
 - 2. Two (2) Coats Ultra Spec 500 Interior Semi Gloss Finish #539 or Ben #W627
- C. Gypsum Board – Latex, Eggshell, 3 coat:
 - 1. One (1) Coat BM Sure Seal Primer Sealer #027: Applied at a dry film thickness of not less than 1.8 mils.
 - 2. Two (2) Coats Ultra Spec 500 Interior Egg Shell #538.
- D. Gypsum Board – Latex, Satin/Semi-Gloss, 3 coat:
 - 1. One (1) Coat –BM Sure Seal Primer Sealer #027: Applied at a dry film thickness of not less than 1.8 mils.
 - 2. Two (2) Coats – Ultra Spec 500 Interior Eggshell or Semi Gloss Finish #538/539.
- E. Natural Wood Beams:
 - 1. Two (2) Coats – Stays Clear Acrylic Polyurethane #423. Applied at a dry film thickness of not less than 1.8 mils.

3.9 COLORS

- A. To be selected by Architect from manufacturer’s color palette or as indicated on Drawings.

END OF SECTION 099100

SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Panel signs (room signs).
 - 2. Parking signs.
 - 3. Traffic signs.
 - 4. Signage accessories.
 - 5. Building sign.
- B. Related Sections include the following:
 - 1. Division 1 Section "Temporary Facilities and Controls" for temporary project identification signs.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.
- B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.
 - 1. Provide message list for each sign, including large-scale details of wording, lettering, artwork, and braille layout.
- C. Samples for Initial Selection: For each type of sign material indicated that involves color selection.
- D. Samples for Verification: For each type of sign, include the following Samples to verify color selected:
 - 1. Panel Signs: Full-size Samples of each type of sign required.
 - 2. Approved samples will not be returned for installation into Project.
- E. Qualification Data: For Installer.
- F. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative of signage manufacturer for installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain each sign type through one source from a single manufacturer.
- C. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

- A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.
 - 1. For signs supported by or anchored to permanent construction, furnish templates for installation of anchorage devices.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signage fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 1 year.
- B. Installer Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Signs: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
 - 1. Best Sign Systems Inc. (Basis of Design)
 - 2. ASI Sign Systems, Inc.
 - 3. Mohawk Sign Systems.
 - 4. Sign A Rama.
 - 5. Or equal.
- B. Exterior Signs: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.

1. Gemini, Inc. (Basis of Design)
2. A.R.K. Ramos Mfg. Co., Inc.
3. La Haye Bronze.
4. Metal Arts; Division of L & H Mfg.
5. Mills Manufacturing. Inc.
6. Southwell Co.
7. Or equal.

2.2 PANEL SIGNS

- A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
 1. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally.
- B. Product: HC300 ADA Sign System by Best Sign Systems.
 1. Unframed Panel Signs: Fabricate signs with edges mechanically and smoothly finished.
 2. Room, Occupancy, Wayfinding Signs: As selected from 4 standard copy size signs.
 - a. 4" x 2" with up to 4 characters each.
 - b. 6" x 2" with up to 8 characters each.
 - c. 8" x 2" with up to 12 characters each.
 - d. 10" x 2" with up to 14 characters each.
 3. Toilet Room Signs: As selected from manufacturer's standard.
 4. Symbols of Accessibility: Provide 6-inch- high symbol fabricated from opaque nonreflective vinyl film, 0.0035-inch nominal thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.
 5. Material:
 - a. 1/4 inch thick (thicker than standard) "MP", acrylic sheet, ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).
 6. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with CBC H17B.5.6. Text shall be accompanied by California Contracted Grade 2 Braille raised domed dots. Produce precisely formed characters with square cut edges free from burrs and cut marks, use dome dots.
 7. Copy: 5/8 inch Helvetica Medium with contracted grade 2 Braille all capital letter on tactile sign.

2.3 PARKING SIGNS

- A. Material: 0.063" aluminum, screen printed copy on engineer grade reflective vinyl sheeting.
 1. Text: Symbols of accessibility, accessible direction, etc. as indicated on Drawings.
- B. Accessible signs are blue with white symbol.
- C. Post: 2 inch diameter, schedule 40 galvanized pipe.

2.4 TRAFFIC SIGNS

- A. Material: 0.080" aluminum, screen printed copy on engineer grade reflective vinyl sheeting.

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1. Text: Stop, Yield, Do Not Enter, etc. as indicated on Drawings.

B. Post: 2 inch diameter, schedule 40 galvanized pipe.

2.5 BUILDING SIGN

A. Custom as indicated on Drawings.

2.6 ACCESSORIES

A. Mounting Methods: Use concealed fasteners fabricated from materials that are not corrosive to sign material and mounting surface.

B. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

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 work.

B. Verify that items, including anchor inserts, provided under other sections of Work are sized and located to accommodate signs.

C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.
 - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
 - 2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.
- B. Wall-Mounted Panel Signs:
 - 1. Interior Signs on Smooth Substrates:
 - a. Silicone-Adhesive Mounting: Use liquid-silicone adhesive recommended in writing by sign manufacturer to attach signs to irregular, porous, or vinyl-covered surfaces. Use double-sided vinyl tape where recommended in writing by sign manufacturer to hold sign in place until adhesive has fully cured.
 - 2. Exterior and Interior Signs on Rough Substrates:
 - a. Mechanical Fasteners: Mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
 - 1) Fastener: Stainless steel screws, tamper-resistant flat head countersink.
 - 2) Anchors: Suitable for secure attachment to substrate.
- C. Parking and Traffic Signs
 - 1. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
 - 2. Install sign level, plumb, and at height indicated.
 - 3. Cap post with galvanized cap.

3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 101400

SECTION 102113 – TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes Phenolic Core toilet compartments.

1.3 SUBMITTALS

- A. Product data for materials, fabrication, and installation including catalog cuts of anchors, hardware, fastenings, and accessories.
- B. Shop drawings for fabrication and installation of compartment assemblies.
- C. Provide template layouts and installation instructions for anchorage devices built into other work.
- D. Samples of full color range for each required unit type. Submit manufacturer's standard color selector.

1.4 QUALITY ASSURANCE

- A. Field Measurements: Take field measurements prior to component fabrication to ensure proper fitting of work.
- B. Coordination: Furnish inserts and anchorages that must be built into other work for installation of toilet compartments.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of toilet compartments that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 1 year.
- B. Installer Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
 - 1. Bobrick. (Basis of Design)
 - 2. Ampco.
 - 3. Accurate Partitions Corp.
 - 4. Metpar.
 - 5. Laminating Technologies.
 - 6. Or equal.

2.2 COMPARTMENTS

- A. Product: Evolve Cubicle Toilet Compartments by Bobrick or equal.
- B. Substrate Material: Compact Grade Laminate (Phenolic Black Core)
 - 1. Materials: Solidly fused plastic laminate with matte-finish melamine surfaces; integrally bonded colored face sheets and black phenolic-resin core.
 - 2. Edges: Black; brown edges not acceptable.
 - 3. Color: As selected by Architect from manufacturer's standard range.
- C. Toilet Compartments:
 - 1. Configuration: Floor-anchored, Overhead-braced toilet cubicles.
 - 2. Door Hardware and Pedestal: clear anodized aluminum
 - 3. Standard Height: Overall height from finished floor to top of headrail is 81-inches consisting of 9-inch floor clearance, 71-5/16-inch doors, and 1-inch headrail.
 - 4. Maximum Height: Overall height from finished floor to top of headrail is 82-5/16-inches consisting of 1-inch floor clearance, 79-5/8-inch doors, 80-inch panels, and 1-5/16-inch headrail.
- D. Fire Resistance: Class A.
 - 1. Flame Spread Index (ASTM E 84): No more than 25 for panels, doors, and fascia panels
 - 2. Smoke Developed Index (ASTM 84): No more than 450 for panels, doors, and fascia panels
 - 3. National Fire Protection Association/International Building Code Interior Wall and Ceiling Finish: Class A
- E. Urinal Privacy Screens:
 - 1. Configuration: Floor-anchored.
 - 2. Screen Size:
 - a. Max Height: 72-inch.
 - b. Max Width: 24-inch.
 - 3. Hardware: 9-inch pedestal, urinal screen hardware to match cubicle hardware.
 - 4. Finished Thickness: 1/2-inch for fascia panels, doors, and panels.
- F. Frame:
 - 1. Headrail: Secured to the top of the fascia for stability
 - 2. Mounting Brackets and Fasteners: Clear anodized aluminum U-Channel brackets.
 - 3. Privacy:
 - a. Full-length clear anodized aluminum frame provides built-in, no-sightline privacy on hinge and keeping-sides of the door.

- b. Continuous clear anodized aluminum U-Channels fasten divider and fascia panels to the wall.
- G. Hardware:
- 1. Compliance:
 - a. Door handle is operable with one hand, without tight grasping, pinching, or twisting of the wrist, and force to operate does not exceed 5 pounds
 - b. Floor Clearance: 9-inch high minimum clearance maintained under fascia panel and side divider panels
 - c. Keyed Emergency Access: Latch allows door to be opened from the outside of the compartment with a 3mm Allen Wrench in emergency release slot in the indicator
 - d. Fastening: Hardware secured to door and fascia by stainless steel sheet metal screws
 - e. Door-closing:
 - 1) Standard: Clear anodized aluminum pedestal secured beneath door incorporates a spring closing mechanism, creating a soft door close and includes (+/-) 1-inch adjustment.
 - 2) Max: Door closer fixed in the headrail incorporates a spring closing mechanism with tension adjustment, creating a soft door close.
 - 2. Door Hardware Type:
 - a. Locking: clear anodized aluminum door handle locates directly into the vertical keeping extrusion. Integral rubber door bumper cushions doors when closing.
 - b. Occupancy indicator: Clear anodized aluminum circular escutcheon with red and white indicator.
 - c. Standard: Cylindrical pedestal supports divider panels and maintains a 9-inch high floor clearance under fascia panel and side divider panels and includes (+/-) 1-inch adjustment.
 - d. Max: Lower door bracket attaches to extrusion for lower pivot point support.
 - e. Robe hook: Clear anodized aluminum in matte finish.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's recommended procedures and installation sequence.
 - 1. Install compartment units rigid, straight, plumb and level. Provide clearance of not more than 1/2" between stiles and panels and not more than 1" between panels and walls. Secure panels to walls with not less than two brackets attached near top and bottom of panel. Locatwall brackets so that holes for wall anchorages occur in masonry or tile joints. Secure panels to stiles with not less than two brackets located to align with brackets at wall. Secure panels in position with manufacturer's recommended anchoring devices.
- B. Overhead Braced Compartments: Secure stile to floor and level, plumb, and tighten installation with devices furnished. Secure overhead brace to each stile with fasteners supplied. Hang doors and adjust so that tops of doors are parallel with overhead brace when doors are in closed position.
- C. Floor Mounted Compartments: Set stile units with anchorages having not less than 2-1/2" penetration into structural floor, unless otherwise recommended by manufacturer. Level, plumb, and tighten installation with devices furnished. Hang doors and adjust so that tops of doors are level with tops of stiles when doors are in closed position.

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- D. Screens: Attach with anchoring devices as recommended by manufacturer to suit supporting structure. Set unit to provide support and to resist lateral impact.

3.2 ADJUST AND CLEAN

- A. Hardware Adjustment:
 - 1. Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation.
 - 2. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched.
 - 3. Set hinges all accessible stalls to return to fully closed position.
- B. Clean and Protect: Clean exposed surfaces of compartment systems using materials and methods recommended by manufacturer, and provide protection as necessary to prevent damage during remainder of construction period.

END OF SECTION 102113

SECTION 102800 – TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes:
 - 1. Toilet and bath accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated on Drawings.
- C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

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- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace toilet and bath accessories that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 1 year.
- B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Toilet and Bath Accessories: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
 - 1. Bobrick Washroom Equipment, Inc. (Basis of Design)
 - 2. American Specialties, Inc.
 - 3. Bradley Corporation.
 - 4. Sonia Bath Accessories.
 - 5. Or equal.

2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008, Designation CS (cold rolled, commercial steel), 0.0359-inch minimum nominal thickness.
- C. Galvanized Steel Sheet: ASTM A 653, with G60 hot-dip zinc coating.
- D. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.
- E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.3 TOILET ACCESSORIES

- A. As indicated on Drawings.

2.4 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104400 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Portable fire extinguishers.
 - 2. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.
 - 3. Mounting brackets for fire extinguishers.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.
 - 1. Fire Extinguishers: Include rating and classification.
 - 2. Fire-Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Samples for Initial Selection: For fire-protection cabinets with factory-applied color finishes.
- C. Samples for Verification: For each type of exposed factory-applied color finish required for fire-protection cabinets, prepared on Samples of size indicated below.
 - 1. Size: 6 by 6 inches square.
- D. Maintenance Data: For fire extinguishers and fire-protection cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.
- 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 FMG.

1.5 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 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: 6 years.
- B. Installer Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Fire Extinguishers and Cabinets: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
 - 1. Larsen's Manufacturing Company. (Basis of Design)
 - 2. JL Industries, Inc.
 - 3. Potter Roemer; Div. of Smith Industries, Inc.
 - 4. Ansul.
 - 5. Or equal.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS), Type B.
- B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
 - 1. Sheet: ASTM B 209.
 - 2. Extruded Shapes: ASTM B 221.
- C. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 1.5 mm thick, with Finish 1 (smooth or polished).

2.3 PORTABLE FIRE EXTINGUISHERS

- A. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. Valves: Manufacturer's standard.
 - 2. Handles and Levers: Manufacturer's standard.

3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
 4. Certification Tag: Provide fire extinguisher with valid certification test tag where fire extinguishers are fully charged and ready to be used.
- B. Dry Chemical Type: Cast steel tank, with pressure gage.
1. Class 2A-10B:C.
 2. Nominal Capacity: Provide largest capacity fire extinguisher that will fit in the cabinet, but 5 lbs. minimum.
 3. Finish: Baked enamel, red color.
 4. Use: General purpose.
- C. Wet Chemical Type: Cast steel tank, pressurized, including hose and nozzle, with bracket.
1. Class 2A-K.
 2. Size 2.5 gal.
 3. Finish: Factory baked enamel, red color.
 4. Use: At kitchens.

2.4 FIRE-PROTECTION CABINET

- A. Product: Architectural Series 2409 by Larsen's.
1. Cabinet Type: Suitable for fire extinguisher.
 2. Construction:
 3. Mounting: Recessed. Provide Semi-recessed.
 4. Cabinet Trim and Door Material: Aluminum.
 5. Door Style:
 - a. Vertical Duo Door with tempered safety glass.
 6. Door Hardware: Manufacturer's accessible door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - a. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
 7. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
 8. Door Lock: Cylinder lock, keyed alike to other cabinets.
 9. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
 - a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Silk-screened.
 - 3) Orientation: Vertical.
 10. Finishes: Factory clear anodized.

2.5 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
1. Color: Red.

- 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.
 - a. Orientation: Vertical.

2.6 FABRICATION

- A. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
 - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 - 2. Miter and weld perimeter door frames.
- B. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.7 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where cabinets will be installed.

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- B. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged units.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for recessed and semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights indicated on Drawings.
- B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104400

SECTION 11 40 00 – FOODSERVICE EQUIPMENT

1.10 ROUGH-IN DRAWINGS

Before continuing with furnishing equipment, the Contractor shall submit prints for approval with verified dimensions and conditions in compliance with the drawings. Approval of such drawings shall not relieve the Contractor from responsibility for any deviation from the drawings and specifications unless such deviations are approved in writing by the University's Representative or the Consultant.

1.11 DELIVERY OF MATERIALS

No provisions shall be made for receipt or storage of any items delivered to job site. All items must be received and accounted for by the Contractor.

1.12 CUTTING AND FITTING

No cutting, drilling, or altering of any kind shall be done to the building by the Contractor without first obtaining permission from the University's Representative.

1.13 SERVICE REPRESENTATIVE

Furnished a manufactures service representative to be present when the equipment is put into operation. The Contractor shall make any adjustments necessary and put into operation all the equipment and instruct by the University's Representative's employees in the proper use and maintenance of all items in this contract.

1.14 WORK TO BE PERFORMED BEFORE AND AFTER KITCHEN EQUIPMENT IS INSTALLED.

A. Plumbing:

1. Rough-in
2. Piping of supply and waste lines from building service to rough-in (unless specifically stated otherwise)
3. Traps, grease traps, line strainers, tail pieces, valves, stops, shutoffs, and miscellaneous fittings required for complete furnish.
4. Final connection.

B. Ventilation:

1. All ductwork and fans above ceiling line including connection to ventilators and/or hoods.

C. Electrical:

1. Rough-in.
2. All electric building services including but not limited to conduit, wiring, line and disconnect switches, safety cut offs and fittings, control panels, fuses, boxes and fittings required for complete furnish, except internal wiring as specified, unless indicated otherwise on drawings.
3. Final connections, including mounting and wiring of starters and switches furnished by the Contractor (unless otherwise indicated on the drawings).

1.15 WORK INCLUDED IN THIS SECTION

- A. Furnish all labor, material, services and specified equipment, necessary for the complete of the foodservice equipment in strict accordance with specifications, applicable drawings, including that which is reasonable inferred, with all related items necessary to complete work shown on contract drawings and/or required by these specifications.
- B. Deliver all equipment on schedule
- C. Cutting of holes in equipment for pipes, drains, electric outlets, as required. Work shall conform to the highest standards of workmanship and shall include welded sleeves, collars, ferrules or escutcheons.
- D. All wall sleeves, chrome plated cover pleats, vermin proofing, and sealing of wall sleeves. Contractor to furnish and install vermin proofing for all floor sleeves he uses.
- E. All work involved in making stands and supports for all specified equipment requiring them.
- F. Foodservice equipment and fixtures shall be cleaned thoroughly and ready for operation at the time the project is turned over to the University's Representative.
- G. Electric Work:
 1. Intertwining of foodservice equipment between components within equipment, such as heating elements, switches, thermostats, motors, complete with junction box or disconnect as is applicable, and ready for final connection.
 2. All electrical inter-wiring done in a fabricators shop or in the field as specified in this Scope of Work, shall be fully tested and certified by a licensed independent agency furnished by the Contractor.
- H. A complete wiring diagram indicating connection points, types of conduits, junction boxes, terminal boxes, breaker panels and other miscellaneous devices shall be listed and detailed in the fabricators shop drawings.
- I. The Contractor shall furnish the agency's name and contact person as well as verification that the agency is accepted by the Contractor. It will be submitted prior to fabrication of custom equipment.
 1. Voltages shall be as indicated on contract drawings. Any difference in electrical characteristics at job site from those shown on contract documents must be submitted for consideration prior to ordering equipment.

J. Plumbing Work:

1. Furnish all equipment with faucets and sink waste assemblies, as specified in this section.
2. Pre-pipe all waste and supply piping for built in fixtures in fabricated counters to shut off or control valves, ready for final connection.

1.16 QUALITY ASSURANCE

- A. All custom fabricated equipment such as tables, sinks, countertops, etc., must be manufactured by a foodservice equipment fabricator who has the plant, personnel and engineering capability required. Such manufacturer shall be subject to the approval. All work in the above category shall be manufactured by one manufacturer and shall be of uniform design and finish.
- B. The manufacturer of this equipment must be able to show that he is now and for the past 5 years has been engaged in the manufacture or distribution of foodservice equipment.

1.17 SUBMITTALS

- A. Submit illustrated brochures for manufactured or "buy-out" equipment items, line drawings, rough-in requirements, and list of accessories or other specified requirements. Brochures included data on all equipment that is to be furnish and installed and arranged in numerical sequence that conforms to the item numbers in the specifications. Omission of data does not reduce the obligation to furnish and install items as specified.
- B. Submit fully dimensioned rough-in plans at 1/4" scale, on reproducible media, showing all required mechanical, electrical, ventilation, water, waste, and refrigeration services required for equipment and rough-in location for same. Rough-in locations shown shall make allowances for required traps, switches, etc. Drawings shall indicate dimensions for floor depressions, wall openings, etc., for equipment.
- C. Submit fully dimensioned and detailed shop drawings, on reproducible media, of custom-fabricated equipment shall be submitted, drawn at 3/4" scale for elevations and 1 1/2" scale for sections. Drawings shall show details of construction, furnish, and relation to adjoining and related work where cutting or close fitting is required. Drawings shall show all reinforcements, anchorage, and other work required for complete furnish of all fixtures. Where fabricator is to pre-wire components to J-box, pull box, breaker panel, etc., all electrical wiring labeling, and method of certification is to be indicated on the drawings.
- D. Submit shop drawings as required for the project.
- E. Rough-In drawings, shop drawings, color and material samples and bound brochures covering manufactured or "buy-out" items covering all work and equipment covered in this contract shall be submitted to the University's Representative as soon as possible but not later than three weeks after the award of the contract. After approval, the Contractor shall furnish to the University's Representative, sets (as required) of shop drawings and brochures, corrected as required by virtue of review comments, for distribution to various interested trades on project. All costs of reproductions and submissions shall be part of the contract.
- F. Do not begin fabrication of custom-manufactured equipment until approvals of shop

drawings have been received, and until field measurements have been taken by the Contractor, where such measurements have been taken by the Contractor, where such measurements are necessary to assure proper conformance with the intent of the contract drawings and specifications.

- G. Make field measurements, giving due consideration to all discrepancies that may occur during the construction of the space. No extra compensation will be allowed for any difference between actual dimensions secured at the job site and dimensions shown on the drawings. Field measurements shall be submitted for consideration before proceeding with the fabrication of equipment.
- H. Shop drawings, detail, and equipment to be reviewed for design concept only, and does not relieve the Contractor of responsibility for compliance with design drawings, details, and specifications. Verification of utilities with equipment requirements for conformity and location and verification of all dimensions of equipment and building conditions or reasonable adjustments due to deviations.
- I. The Contractor shall prepare and submit for review a complete and itemized listing of items and services ordered, procured, and otherwise arranged for to complete his work including purchase order numbers, projected ship dates, and pertinent comments. This listing shall be updated and distributed on a bi-monthly basis and on a weekly basis during the four (4) week period preceding the commencement of furnish.

1.17 DRAWINGS

- A. Drawings that constitute part of the contract documents indicate general arrangement of piping and location of equipment. Should it be necessary to deviate from the arrangement indicated in order to meet structural or other field conditions, the Contractor shall submit an RFI to the University's Representative.
- B. Exact locations, distances, and levels shall be governed by the building.

1.18 MANUFACTURER'S DIRECTIONS

- A. Follow the manufacturer's directions in all cases where manufacturers of articles used in this contract furnish directions or prints covering points not shown on drawing or specifications.

1.19 INDUSTRY STANDARDS

- B. Electrically operated and/or heated equipment, fabricated or otherwise, shall conform to the latest standards of National Electric Manufacturer's Association and of Underwriters Laboratories, Inc. and shall bear the U.L. label.
- C. Items of foodservice equipment furnished shall conform to standards of National Sanitation Foundation, Ann Arbor, Michigan, and shall bear the N.S.F. seal.
- D. Foodservice equipment shall be installed in accordance with N.S.F. standards.
- E. Work and materials shall follow the requirements but not limited to those of the National Fire Protection Association, State Fire Marshall, State Board of Health, Local Health Applicable code requirement.

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- F. All standard steam-heated equipment shall be manufactured in accordance with A.S.M.E. applicable code requirements and carry the A.S.M.E. stamp.
- G. Whenever the drawings and specifications require larger sizes or higher standards than are required by the regulations, the drawings and standards shall govern.
- H. Whenever the drawings and specifications indicate requirements which will violate the regulations, the regulations shall govern.
- I. No extra charge will be paid for furnishing items required by the regulations, but not specified or shown on the drawings.
- J. Rulings and interpretations of enforcing agencies shall be considered part of regulations.

2.1 MANUFACTURED ITEMS

- A. Except as may be specified otherwise under individual item specifications in the "Equipment Schedule," all items of standard manufactured equipment furnished shall be complete in accord with manufacturer's standard specifications for specific unit of model called for, including finishes, components, attachments, appurtenances, etc.
- B. Substitutions for manufactured equipment specified will be given consideration.

2.2 FABRICATED METAL EQUIPMENT

- A. Work shall be done in an approved workmanship manner, to complete satisfaction of the University's Representative. Further, work included under this heading shall conform to the National Sanitation Foundation (NSF).
- B. Stainless steel – shall be U.S. standard gauges as called for, 18-8, Type 304, not over .021% maximum carbon, and with a #4 finish unless stated otherwise. All stainless-steel welds shall be ground smooth to match the original grain.
- C. Galvanized iron – shall be Armco or equal. Framework of galvanized iron shall be welded construction, having welds smooth, and where galvanizing has been burned off, touched up with high-grade aluminum bronze.
- D. Legs and Cross rails – shall be continuously welded, ground smooth and polished to have a uniform finish. Legs on sinks and tables shall be spaced no further than 66" on centers and 30" front to back.
 - 1. Legs shall be fastened to equipment as follows.
 - 2. To sinks by means of closed gussets. Gussets shall be stainless steel, welded to the underside of the sink, with 14-gauge s/s gusset plates, having set screws for securing legs.
 - 3. To tables and drain boards with closed gussets, which shall be welded to, galvanized hat sections or 2 channels (stainless steel for drain boards and dish tables), 14 gauge or heavier, exposed hat sections having closed ends.

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- E. Feet – Legs shall be fitted with an adjustable stainless steel bullet foot that is adjustable to a minimum of 1” in either direction from its mid-point. In cases where drawings show flanged feet, the flange shall be secured to the floor by means of 2 s/s bolts per flange.
- F. Closed gussets – shall be 3” minimum at the top, welded to frame members or gusset plate.
- G. Wastes – Pot, prep or utility sinks should be fitted with lever or twist-type wastes (refer to drawings), without rear connected overflows, unless otherwise specified. Where exposed, furnish wastes chromium plated. Handles shall project through a 12-gauge guide bracket welded to the forward edge of the underside of the sink.
- H. Rolls- shall be, except as detailed to the contrary, as per Standard Detail No. A.1.
 - 1. Where roll occurs in customer view – all faucets should be polished to a #4 finish.
 - 2. Where roll occurs in customer view all faucets should be polished to a #4 finish.
- I. Seams and Joints – shall be shop welded whenever possible. Welds to be ground and polished to match original finish. Field welding shall be done to the same quality as if it were done in the shop.
- J. Metal Tops – shall be one-piece construction, unless specified otherwise, reinforced on underside with galvanized (stainless steel for dish tables and sinks) hat channels or “c” channels secured into place by means of either spot welding or stud bolted. All cracks and crevices shall be sealed. Cross bracing shall not be more than 36” on centers.
- K. Drawers – shall be 18-gauge stainless steel channel – type housing and 16-gauge drawer cradle, both housing and cradle being reinforced and welded at corners. Housing to be secured to underside of top by bolting to studs welded to top. Unit to be sized for and fitted with 20” x 20” x 5” deep drawer insert pan made of stainless steel, having coved corners. Drawers insert to be easily removable from cradle without tools or having to remove the entire drawer. Bottoms of housing shall have an s/s, 18 gauge, welded horizontal panel if the bottom of the housing is above another drawer or less than 18” above the finished floor.
 - 1. Drawer Slides – shall be 14-gauge, ball bearing type and mounted so that the drawer is “self-closing” by means of gravity. Outer slide shall be welded to an s/s channel on the inside of the drawer housing. Manufactured drawer slides are to be Series 3320, 250-pound capacity, made by Grant Pulley & Hardware Co. or equal.
 - 2. Drawer Fronts – shall be double pan type, not less than 5/8” thick, with seams on inside face. Pans shall be welded together with full insulation between pans. Fronts shall be formed with built-in, FULL-LENGTH HANDLES AS PER STANDARD DETAIL.
 - 3. Hardware – shall be of solid materials and except where specified to the contrary or unexposed, be of cast brass, chrome plated. Name all hardware with manufacturer’s name and number so that broken or worn parts may be ordered and replaced.

- L. Sink Compartments – shall have $\frac{3}{4}$ " coved vertical and horizontal corners. Multiple compartment partitions to be double thickness, continuously welded where sheets join at top. Fronts of multiple compartment sinks to be continuous on exterior. Bottoms to be creased to drain. Sink inserts for metal tops shall be welded integral with the top. Sink bowls shall be supplied with rotary wastes unless specified otherwise.
- M. Ends of Fixtures, backsplash, shelves, etc., - shall be finished flush to walls or adjoining fixtures.
- N. Bends – on dish tables, drainboards, backsplash, turn-up edges etc., shall be coved in all vertical and horizontal corners and coved at intersections. Rounded and coved corners or radius bends shall be $\frac{1}{2}$ "radius or larger.
- O. Underside of Tops – shall be coated with heavy – bodied resinous material compound for permanent, non-flaking adhesion to metal, $\frac{1}{8}$ " thick, applied after reinforcing members have been installed, drying without dirt-catching crevices. Compound (where exposed) shall be spray painted with aluminum bronze.
- P. Shelves – To be turned up 2" on the back edge. Turn other edges down $1\frac{1}{2}$ " to form open channels. Reinforce shelf with channel bracing on not less than 60" centers.
- Q. Casework – At Contractor's option unless otherwise indicated, furnish and install either box-type framing or open channel type (complying with N.S.F. requirements in either case). Fabricator shall fully detail the method of construction on all shop drawings.
- R. Enclosures – Except where otherwise indicated, furnish and install each unit of casework (base, wall overhead, and free standing) with a complete enclosure metal cabinet, including fronts, backs, tops, bottoms, and sides.
- S. Insulation
 - 1. For heated fixtures furnish and install 1# minimum fiberglass, #3 density, as manufactured by Libby Owens Ford Corp. or equal.
 - 2. For cold fixtures, furnish and install rigid urethane foam or foamed in place urethane, in thickness indicated on details and drawings. Bond insulation to all surfaces.
- T. Doors
 - 1. All doors to be double pan, reinforced and stiffened to prevent flexing, filled with sound deadening material and are formed with built-in, full-length handle.
 - 2. Sliding doors shall be mounted with large and quiet ball bearing wheels in 14-gauge stainless steel overhead track and to be removable without the use of tools.
 - 3. Hinged doors shall be flush type and mounted on heavy-duty, stainless steel, lift-hinges.
- U. Refrigerated Items/Ice Bins-
 - 1. All self-contained refrigeration systems furnished under this contract shall include a five-year guarantee on the sealed portion of hermetic – type compressors.

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2. All coils for standard and fabricated refrigerators shall have vinyl plastic coating and anti-corrosion type housings and shall be installed in such a manner as to be replaceable.
3. All reach – in refrigerators and freezers for remote refrigeration systems shall be complete with thermostatic expansion valves.
4. Fabricated refrigerated compartments, fabricated and standard, shall be fitted with a dial-type thermometer with chrome plated bezels. Thermometers shall be adjustable and calibrated after furnish.
5. Fabricated refrigerated compartments shall be furnish and install with 20-gauge stainless steel boxes to house expansion valves when valve is remote from coil. Install in base of fixture or in a concealed position.
6. Hardware for fabricated and standard refrigerated compartments shall be heavy duty components. Hinges shall be self-closing. Latches to be positive, edge-mount type unless specified or detailed otherwise.
7. All ice pans; ice bins, refrigerated pan and openings shall be furnish and install with breaker strips when adjoining top or cabinet openings to prevent condensation.
 - a. Flanges shall be box type and polished to a #8 finish where exposed to customer view.
 - b. All must meet NSF 7 standards.

V. Wall Flashing

1. Cover all exposed wall areas, full length, full width, including columns, wall extensions, and from the top of floor base to underside of ventilator with 20-gauge stainless steel.
2. Flashing shall be fabricated from maximum length sheets for a minimum of vertical joints. Horizontal joints are not acceptable. Secure edges at joints with “C” or “T” strips, without exposed screws or fasteners.
3. Furnish and install chrome-plated or stainless steel escutcheons at wall piping penetrations where exposed.
4. Furnish and install chrome-plated or stainless steel escutcheons at wall piping penetrations where exposed.
5. At exposed corners, furnish and install 2” x 2”, 16-gauge stainless steel guards.

W. Gauges of Metal Components – to be as follows (unless specified otherwise):

Tabletops	14 ga	stainless steel
Wall Shelves	16 ga	stainless steel
Shelf Bracket	14 ga	stainless steel

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Undershelves	16 ga	stainless steel
Drawer fronts	16 ga	stainless
steel Encl. Cabinet bases	18 ga	stainless steel
Framework	14 ga	galvanized or ss as specified
Refrigeration interior	18 ga	stainless steel
Sinks & Drainboards	14 ga	stainless steel
Exhaust hoods	18 ga	stainless steel
Legs (1 5/8" dia.)	16 ga	stainless steel
Cross bracing (1-5/8" dia.)	16 ga	stainless steel
Doors (outer pan)	18 ga	stainless
steel Doors (inner pan)	20 ga	stainless
steel		
Hat Sections/Channels		
Exposed	14 ga	stainless steel
Unexposed	14 ga	galvanized
Ductwork		
Exposed	16 ga	stainless steel

2.3 HEATING EQUIPMENT

- A. Wherever heating equipment or thermostat control for such equipment is specified, it shall be complete, and of the materials, size and rating specified within equipment items or details. All such equipment shall be designed and installed to be easily removed for cleaning.
- B. Electrical appliances or heating element circuits of 120 volts shall not exceed 1650 watts, unless specifically shown to the contrary.

2.4 SWITCHES AND CONTROLS

- A. All internal wiring for fabricated equipment items, including all electrical devices, wiring, controls, switches, etc., built into or forming an integral part of these items shall be furnished and installed by Contractor in his factory or building site with all items complete to junction box, pull box, or breaker panel (see plans and specifications) for final connection to building lines by the Contractor.
- B. Furnish and install standard 3 prong plugs to fit "U" slot grounding-type receptacles, for all equipment items powered by plugging into 110 – 120 volts, single phase AC.
- C. All electrical outlets and switches furnish and install as a part of fabricated equipment, shall be mounted in recessed S/S pans similar to Component Hardware. All switches shall have bright pilot light built into pan.

2.5 CONNECTION TERMINALS

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- A. All equipment shall be equipped with connection terminals as standardized by equipment manufacturer, except where specified otherwise. It shall be the responsibility of the Contractor to furnish and install all required adapters to assure proper connection to the conditions at the job site.
- B. All electrical inter-wiring done in the fabricators shop or in the field as specified in this Scope of work shall be fully tested and certified.

2.6 LOCKS

- A. Fit all doors for reach in refrigerated compartments with locking type latches. Key all locks differently except where multiple locks occur on the same item. Key all locks to one master key. Furnish 2 keys for each lock and a total of 4 master keys.

2.7 LAMINATE PLASTIC

- A. Wherever laminate plastic materials are specified, veneer all materials using urea base cement, waterproof, and heatproof. Rubber base adhesives are not acceptable. Apply materials directly over close grained plywood face exposed surfaces and edges with 1/16" material. Corresponding back faces may be finished with 1/32" reject material in some cases. Place top sheet on and over finished edge.

3.1 GENERAL

- A. Work under the contract and covered under this section of specification includes but is not limited to:
 - 1. Cutting of holes and/or ferrules on equipment for piping, drains, electrical outlets, conduits, etc., as required to coordinate furnish of kitchen and foodservice equipment work of the other Contractors on the project.
 - 2. Field checking of building and rough-in requirements, and submission of brochures and shop drawings, all as required herein before under, Section 1.5, "Submittals."
 - 3. Replace all damage to premises as result of this furnish, and removal of all debris left by those engaged in this furnish.
 - 4. Having all foodservice equipment fixtures completely cleaned and ready for operation when the project is turned over to University's Representative.

3.2 FURNISH PROCEDURES

- A. The Contractor shall make arrangements for receiving his custom fabricated and "Buy-out" equipment and shall make delivery into building as required by progress of the project and scheduled through the Contractor. He shall not consign any equipment to the University's Representative or to any other Contractor unless he has written acceptance from them and has made satisfactory arrangements for the payment of freight and all handling charges. No provisions will be made at the job site for the temporary storage of equipment.

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- B. The Contractor shall deliver all of his custom fabricated and “buy-out” equipment.
- C. The University’s Representative or their agents shall have access at all times to plant or shop in which custom fabricated equipment is being manufactured, from time contract is awarded until the equipment is shipped, in order that progress of work can be checked, as well as any technical problems that may arise in coordination of equipment with building. Any approval given at this point of manufacture shall be tentative, subject to final inspection and test after completion.
- D. The Contractor shall keep premises free from debris and rubbish generated by his efforts. He shall be responsible for keeping his areas orderly at all times.
- E. The Contractor shall assist the University’s Representative or the University’s Representative’s agent in making any desired tests during or prior to final inspection of equipment; he shall remove immediately any work or equipment rejected by University’s Representative, and/or University’s Representative’s agent, replacing same with work conforming with contract requirements.
- F. The Contractor shall furnish and install and maintain coverings or other approved protection for finished surfaces and other parts of his equipment subject to damage during and after erection. After removal of protective coverings, the entire work shall be thoroughly cleaned and polished by same.

3.3 TRIMMING AND SEALING EQUIPMENT

- A. Seal completely spaces between all units to walls, ceilings, floors, and adjoining (not portable) units with enclosed bodies against entrance of food particles or vermin by means of trim strips, welding, or commercial joint material best suited to nature of equipment and adjoining material.
- B. Close ends of all hollow sections.
- C. Equipment butting against walls, ceilings, floor surfaces and corners, fitting tightly against same; backsplashes or risers that fit tightly against wall to be neatly scribed and sealed to wall with Dow Corning 732 RTV or GE silicone, in a color that best matches the adjoining surfaces. Where required to prevent shifting of equipment and breaking wall seal, anchor them to the floor.

3.4 TESTING AND DEMONSTRATION OF EQUIPMENT

- A. After completion, all items of equipment furnished under this contract shall be thoroughly tested to ensure proper and safe operation.
- B. The Contractor shall arrange to have all manufactured and mechanical operated equipment furnished under this contract demonstrated by manufacturer’s representatives. These representatives are to instruct the University’s Representative or his personnel in the use, care maintenance of all items of equipment after same is in good working order. Demonstration and instruction shall be at the dates and times designated by the University’s Representative.
- C. Contractor shall furnish and install a competent service representative to be present when furnish is put into operation.

EQUIPMENT SCHEDULE

Contractor shall furnish and install the following custom fabricated and "buy-out" equipment.

ITEM # 101 MOBILE SECURITY SHELVING UNIT
Dimensions:
Quantity: Three (3)
Manufacturer: ULINE
Model: H2657

Three (3)

ITEM # 201 MOP SINK CABINET
Dimensions: 84(h) x 25.19(w) x 22.75(d)
Quantity: One (1)
Manufacturer: Advance Tabco
Model: 9-OPC-84

One (1) Cabinet with Mop Sink, 25-3/16"W x 22-3/4"D x 84"H, mop sink base with drain (bowl 16" x 20" x 12"), left hinged door, (2) mop holders, (1) fixed intermediate shelf, slotted side panels for ventilation, 16/304 series stainless steel sink bowl, 18/304 series stainless steel sink bowl apron, 18/430 series stainless steel cabinet, NSF (right hinged door available on request)

One (1) Service Sink Faucet, wall mount, 8" OC, 6-1/2" spout, with hose thread & pail hook, vacuum breaker spout, wall braced, chrome-plated brass

ITEM # 202 MOP SINK CHEMICAL DISPENSER
Dimensions:
Quantity: One (1)
Manufacturer: Ecolab
Model: APEX

One (1) BY VENDOR

ITEM # 203 HAND SINK, WALL MOUNTED
Dimensions: 12.75(h) x 17.25(w) x 15.25(d)
Quantity: One (1)
Manufacturer: Advance Tabco
Model: 7-PS-40

One (1) Hand Sink, wall mounted, 14" wide x 10" front-to-back x 5" deep bowl, 20 gauge 304 stainless steel, 7-3/4" high side splashes, with splash mounted faucet, lever drain with overflow, P-trap, wall bracket, NSF, cCSAus

One (1) Wrist Handles Only, for splash or deck mount hand sink faucet (1 pair hot & cold 4" long blades), fits faucets supplied after November 2015 with hot & cold color rings that do not have exposed screw head

One (1) Low-flow aerator 0.5gpm, fits 55/64-27 male or 15/16-27 female thread on spout, conforms to California AB 1953

One (1) Side Mounted Wall Bracket (set of 2), for added strength

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ITEM # 204 SOAP DISPENSER
Dimensions: 8.5(h) x 3.5(w) x 3(d)
Quantity: One (1)
Manufacturer: Advance Tabco
Model: 7-PS-12

One (1) Soap Dispenser, wall mounted, 3-1/2"W x 3"D x 8-1/2"H, 20 oz. smoked plastic liquid soap reservoir, push button dispensing, chrome plated plastic body, includes: adhesive strip & mounting bracket

ITEM # 205 PAPER TOWEL DISPENSER
Dimensions: 15(h) x 11(w) x 4(d)
Quantity: One (1)
Manufacturer: Advance Tabco
Model: 7-PS-35

One (1) Paper Towel Dispenser, wall mounted, locking, 11"W x 4"D x 15"H, for use with "C" fold towels, paper towel level indicator, satin finish stainless steel. includes (2) keys & mounting hardware

ITEM # 206 TRASH RECEPTACLE
Dimensions: 30(h) x 22(w) x 11(d)
Quantity: Three (3)
Manufacturer: Rubbermaid Commercial Products Model:
FG354060GRAY

Three (3) Slim Jim® Container, 23 gallon, 22"W x 11"D x 30"H, with venting channels, molded-in handles, general purpose waste, open type without lid, high-impact plastic construction, gray, Made in USA
Three (3) Slim Jim® Swing Lid, for Slim Jim® Container, gray, Made in USA (contact Rubbermaid for broken case information)

ITEM # 207 SS WALL FLASHING
Dimensions:
Quantity: One (1)
Manufacturer: ST. STL. Fabricator
Model: WALL FLASHING

One (1) Wall Flashing, 18 GA stainless steel panels, 48" wide, height from 6" curb to ceiling, vertical grain, adhere flashing to wall with heat resistant mastic, use 2" wide stainless steel divider strips and end caps for a finished appearance, place corner guard over wall flashing and seal to wall. See drawings for more information and details, Size and shape pre plan.

ITEM # 208 3-COMPARTMENT SINK
Dimensions: 45(h) x 89(w) x 28(d)
Quantity: One (1)
Manufacturer: Advance Tabco
Model: 94-23-60-18L

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One (1) Regaline Sink, 3-compartment, with left-hand drainboard, 20" front-to-back x 20"W sink compartments, 14" deep, with 11"H backsplash, stainless steel legs with adjustable left- to-right and front cross rails, 18" drainboard, 1" adjustable bullet feet, 14 gauge 304 stainless steel, overall 28" F/B x 89" L/R, NSF

Three (3) Lever Waste Drain, twist handle operated with built in overflow, fits 3-1/2" drain opening, 2" NPT & 1-1/2" IPS outlet connections

Three (3) Support Bracket, for lever waste drain handle, (1) support required for each lever drain
One (1) Drainboard Corner Turn (each)

ITEM # 209 FAUCET, SPLASH MOUNT

Dimensions:

Quantity: Two (2)

Manufacturer: T&S Brass

Model: B-0231

Two (2) Sink Mixing Faucet, wall mount, 8" centers, 12" swing nozzle, lever handles, quarter- turn Eterna cartridges, 1/2" NPT female inlets, low lead, ADA Compliant

Two (2) Wrist Action Handle, 4" long, hot index & screw Two (2)

Wrist Action Handle, 4" long, cold index & screw

ITEM # 210 PRE-RINSE FAUCET W/ ADD ON FAUCET

Dimensions: 39.5(h)

Quantity: One (1)

Manufacturer: T&S Brass

Model: B-0133-10CRBJST

One (1) Pre-Rinse Unit, EasyInstall wall mount mixing faucet with 8" adjustable centers, quarter-turn Cerama cartridges with check valves, lever handles with color coded indexes, add-on faucet with 10" swing nozzle, 44" flexible stainless steel hose, 1.07 gpm spray valve with swivel, 6" wall bracket, finger hook, accessory fitting tee, 1/2" NPT male elbow installation kit

ITEM # 211 WALL SHELF

Dimensions: 13.5(h) x 36(w) x 15(d)

Quantity: Two (2)

Manufacturer: Advance Tabco

Model: WS-15-36-16

Two (2) Shelf, wall-mounted, 36"W x 15"D, 1-5/8" bullnose front edge, 1-1/2"H rear up-turn, 16/304 satin finish stainless steel, NSF

ITEM # 212 WALL SHELF

Dimensions: 13.5(h) x 24(w) x 15(d)

Quantity: Two (2)

Manufacturer: Advance Tabco

Model: WS-15-24-16

Two (2) Shelf, wall-mounted, 24"W x 15"D, 1-5/8" bullnose front edge, 1-1/2"H rear up-turn, 16/304 satin finish stainless steel, NSF

ITEM # 213 SS WORK COUNTER W/ SINK
FOODSERVICE EQUIPMENT

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Dimensions:

Quantity: One (1)
Manufacturer: ST. STL. Fabricator
Model: CUSTOM

One (1) WORK Counter 14 Ga. S/S top, 8" x 2" backsplash at walls. All 18GA S/S cabinet and cabinet section with 18 GA S/S intermediate and bottom shelves. 14 GA S/S cabinet base channels. S/S legs adjustable bullet feet. . All S/S cabinet construction, S/S intermediate and bottom shelves, S/S base channels. See drawings for more information and details. Size and shape per plan.

ITEM # 214 SHELVING, WALL MOUNTED
Dimensions: 13.5(h) x 60(w) x 15(d)
Quantity: Two (2)
Manufacturer: Advance Tabco
Model: WS-15-60

Two (2) Shelf, wall-mounted, 60"W x 15"D, 1-5/8" bullnose front edge, 1-1/2"H rear up-turn, 18/430 satin finish stainless steel, NSF

ITEM # 215 POT & PAN DISPENSER
Dimensions:
Quantity: One (1)
Manufacturer: Ecolab One (1) BY

VENDOR

ITEM # 216 SS CORNER GUARDS
Dimensions:
Quantity: Three (3)
Manufacturer: ST. STL. Fabricator
Model: CUSTOM

Three (3) Corner Guard, 16 GA. SS, type 304 stainless steel, 72" x 2-1/2" x 2-1/2". Kink Edges. See drawings for more information and details. Size and shape per plan.

ITEM # 301 AIR CURTAIN, CEILING MOUNTED
Dimensions:
Quantity: One (1)
Manufacturer: Mars Air Systems
Model: PH1036-1UA-PW

One (1) Phantom 10 air curtain for 36"W door, unheated, aluminum cabinet, Pearl White powder coat finish, (1) 1/2 HP motor, 115v/60/1-ph, cETLus
One (1) 5 year warranty, standard
One (1) 1 year warranty for all parts (except filters), standard One (1)
Magnetic switches
One (1) Magnetic Reed Switch, commercial, surface mounted
One (1) Motor control panel for unheated units, remote mounted, (1) 1/2 HP motor maximum, 115v/60/1-ph
One (1) Magnetic reed switch, commercial plastic body for surface mounted applications, 24v, NEMA 1 (requires controller, or motor control panel with MCP-24v)
One (1) Accessory, panel mounted 24v transformer (adder for motor control panel)

ITEM # 302 REFRIGERATOR, 2-DOOR REACH-IN
Dimensions: 78.38(h) x 54.13(w) x 29.5(d)
Quantity: One (1)
Manufacturer: True Mfg. - General Foodservice Model:
 TS-49-HC

One (1) Refrigerator, reach-in, two-section, (2) stainless steel doors, (6) gray PVC coated adjustable wire shelves, LED interior lighting, stainless steel front/sides, stainless steel interior, 4" castors, R290 Hydrocarbon refrigerant, 1/2 HP, 115v/60/1-ph, 5.4 amps, NEMA 5-15P, cULus, UL EPH Classified, CE, Made in USA

One (1) Self-contained refrigeration standard

One (1) 7 year compressor warranty, 6 years parts warranty, 5 year labor warranty standard.

Please visit www.truemfg.com for specifics standard

One (1) Left door hinged left, right door hinged right standard One (1)
4" stem castors, standard (adds 5" to OA height)

ITEM # 303 FREEZER, SINGLE DOOR
Dimensions: 78.38(h) x 27(w) x 29.5(d)
Quantity: One (1)
Manufacturer: True Mfg. - General Foodservice Model:
 T-23F-HC

One (1) Freezer, reach-in, one-section, -10°F, (1) solid door, (3) PVC coated adjustable wire shelves, interior lighting, stainless steel door, stainless steel front, aluminum sides, clear coated aluminum interior with stainless steel floor, 4" castors, R290 Hydrocarbon refrigerant, 1/2 HP, 115v/60/1-ph, 3.7 amps, NEMA 5-15P, cULus, UL EPH Classified, Made in USA, ENERGY STAR®

One (1) NOTE: Commonly stocked model in right & left hinge; verify availability with factory One (1) Self-contained refrigeration standard

One (1) 7 year compressor warranty, 6 years parts warranty, 5 year labor warranty standard.

Please visit www.truemfg.com for specifics standard

One (1) Door hinged right standard

One (1) 4" stem castors, standard (adds 5" to OA height)

ITEM # 304 SS WORK COUNTER W/ MILLWORK DOOR FRONTS
Dimensions:
Quantity: One (1)
Manufacturer: ST. STL. Fabricator
Model: CUSTOM

One (1) S/S countertop W/ SS lined millwork doors and SS Counter body. All 18 Ga. S/S cabinet construction, provide SS intermediate and bottom shelves, SS base channels. See drawings for more information and details. Size and shape per plan.

ITEM # 305 HAND SINK FAUCET, DECK MOUNTED
Dimensions:
Quantity: One (1)
Manufacturer: T&S Brass
Model: B-1110

One (1) Faucet, 6" swing nozzle, deck mounted, quarter-turn Eterna cartridges, lever handles, low lead, ADA Compliant

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ITEM # 306 FAUCET, DECK MOUNTED
Dimensions:
Quantity: One (1)
Manufacturer: T&S Brass
Model: B-0226

One (1) Mixing Faucet, deck mount, 10" swing nozzle, 4" centers with 1/2" IPS eccentric flanged female inlets, quarter-turn Eterna cartridges, lever handles, low lead, ADA Compliant

ITEM # 307 SS WORK COUNTER W/ MILLWORK DOOR FRONTS
Dimensions:
Quantity: One (1)
Manufacturer: ST. STL. Fabricator
Model: CUSTOM

One (1) S/S Millwork countertop W/ SS lined millwork doors and SS Counter body. All 18 Ga. S/S cabinet construction, provide SS intermediate and bottom shelves, SS base channels. See drawings for more information and details. Size and shape per plan.

ITEM # 308 6-BURNER RANGE W/ OVEN
Dimensions: 47(h) x 36(w) x 34.25(d)
Quantity: One (1)
Manufacturer: Garland/US Range
Model: S686

One (1) Sentry Series Restaurant Range, electric, 36", (6) all purpose tubular element burners, standard oven, 10" high backguard, all stainless steel exterior finish, 6" stainless steel legs, 15 kW (Garland)
One (1) One year limited parts and labor warranty, covers products purchased and installed in the USA only, standard
One (1) 208v/60/1-ph, 71 amps, standard
One (1) 10" High backguard, standard

ITEM # 309 EXHAUST HOOD
Dimensions:
Quantity: One (1)
Manufacturer: CAPTIVE AIRE
Model: 3044

One (1) BY MECHANICAL CONTRACTOR

ITEM # 310 EXHAUST HOOD ANSUL CABINET
Dimensions:
Quantity: One (1)
Manufacturer: CAPTIVE AIRE
Model: ANSUL

One (1) BY MECHANICAL CONTRACTOR

ITEM # 311 MILLWORK WALLSHELF
FOODSERVICE EQUIPMENT

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Dimensions:

Quantity: One (1)

Manufacturer: By Millwork Contractor

Model: CUSTOM

One (1) BY MILLWORK CONTRACTOR

ITEM # 312 MILLWORK TOP W/ SS WORTABLE

Dimensions:

Quantity: One (1)

Manufacturer: ST. STL. Fabricator

Model: CUSTOM

One (1) Millwork Top w/ SS Worktable, S/S cross bracing notched, S/S bottom undershelf as indicated on elevations. S/S legs w/ S/S bullet feet, See Drawings for more information and details, Size and shape per plan.

ITEM # 313 MICROWAVE OVEN

Dimensions: 12(h) x 20.13(w) x 16.5(d)

Quantity: One (1)

Manufacturer: Panasonic

Model: NE-1064F

One (1) PRO Commercial Microwave Oven, 1000 Watts, 0.8 cu. ft. capacity, (6) power levels, 2- & 3-stage cooking, 20 program memory capacity, touch control pad with Braille, 99-minute timer, programmable and manual operation, program list/cycle counter, self-diagnostics, tone control, bottom energy feed, interior light, see-through door with "grab & go" handle, stainless steel front, cabinet & cavity, 120v/60/1-ph, 13.4 amps, cord, NEMA 5-15P, cULus, NSF

One (1) 1 year parts & labor warranty (or 18,000 cycles) whichever comes first and 3 year magnetron warranty (or 54,000 cycles) whichever comes first

END OF SECTION

SECTION 115213 - PROJECTION SCREENS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 1. Front-projection screens.
 2. Projectors.
 3. Projector mount brackets.

1.3 DEFINITIONS

- A. Gain of Front-Projection Screens: Ratio of light reflected from screen material to that reflected perpendicularly from a magnesium carbonate surface as determined per SMPTE RP 94.
- B. Half-Gain Angle: The angle, measured from the axis of the screen surface, to the most central position on a perpendicular plane through the horizontal centerline of the screen where the gain is half of the peak gain.

1.4 SUBMITTALS

- A. Product Data: For each type of screen indicated.
- B. Samples for Initial Selection: For finishes of surface-mounted screen cases.
- C. Maintenance Data: For projection screens to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain projection screens through one source from a single manufacturer. Obtain each screen as a complete unit, including necessary mounting hardware and accessories.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver projection screens until building is enclosed and other construction within spaces where screens will be installed is substantially complete and ready for screen installation.

1.7 COORDINATION

- A. Coordinate layout and installation of projection screens with adjacent construction, including ceiling framing, light fixtures, HVAC equipment, and partitions.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of projection screens that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 1 year.
- B. Installer Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Projection Screens: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
 - 1. Draper. (Basis of Design)
 - 2. Da-Lite.
 - 3. Or equal.
- B. Projector: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
 - 1. Epson.
 - 2. Hitachi.
 - 3. Sony.
 - 4. Panasonic.
 - 5. Dell.
 - 6. Or equal.
- C. Projector mounting brackets: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
 - 1. Draper. (Basis of Design)
 - 2. Peerless Industries, Inc.
 - 3. Or equal.

2.2 FRONT-PROJECTION SCREENS

- A. Product: Acumen XL V, motorized by Draper or equal.
 - 1. Size: As indicated on Drawings.
 - 2. Format: HDTV format (16:9).
 - 3. Mounting: Recessed into the ceiling.
 - 4. Viewing Surface: Matt White XT1000E (1.0 gain): GREENGUARD Gold certified.
 - 5. Case color: White (standard).
 - 6. Shipping Option: Complete Unit Now.

7. Motor and controls: 110-120V AC (standard).

2.3 PROJECTOR

- A. Product: Pro L30002UNL Laser WUXGA 3LCD Projector by Epson or equal.
 1. Large-venue projector delivers WUXGA performance with Epson® 4K Enhancement Technology.
 2. Projection System: High-aperture Epson 3-chip 3LCD technology.

2.4 PROJECTOR MOUNTING BRACKETS

- A. Draper. Aero Accuset Adjustable Mount.
 1. Maximum load 26 pounds.
 2. Adjustable: +/- 30 degree pitch at ceiling plane and 360 degree yaw. Set screw.
 3. Adjustable: +/- 30 degree pitch at ball joint, +/- 30 degree roll, and 360 degree yaw. Locks with set screw.
 4. Adjust up to 149 inches from ceiling.
 5. Finish: matt black.
 6. For sloped ceilings, provide Accuset Angled Ceiling Plate.
 7. Accessories:
 - a. Accuset Suspended-Ceiling Panel for areas with acoustical ceiling panels.
 - b. Escutcheon Ring for areas with hard-lid ceilings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install projection screens at locations indicated to comply with screen manufacturer's written instructions.
- B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.
 1. Test manually operated units to verify that screen operating components are in optimum functioning condition.

3.2 PROTECTING AND CLEANING

- A. After installation, protect projection screens from damage during construction. If damage occurs despite such protection, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

END OF SECTION 115213

SECTION 116001 – STAGING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Moveable Stage.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Provide test results by certified independent testing laboratory indicating compliance with performance requirements.
 - 2. Rated capacities, construction details, material descriptions, dimensions of individual components, profiles, and finishes.
 - 3. Maintenance instructions and recommendations.
 - 4. Acoustical testing data demonstrating minimal compliance with required acoustical performance criteria.
- B. Shop drawings.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain all products from a single manufacturer through one source providing a comprehensive material and installation package:
- B. Manufacturer Qualifications: Minimum 5 years' experience in design and manufacturing of similar products on projects of similar size, scope and complexity, and with the production capacity to meet the construction and installation schedule.
- C. Installer Qualifications: ESTA-certified and experienced in installation of the work of this section and acceptable to the manufacturer and in the regular employ of the manufacturer.
- D. Regulatory Requirements: Where components are indicated to comply with accessibility requirements, comply with the U.S. Architectural and Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities".

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 3 years.
- B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Stage Platforms:
 - 1. Sico. (Basis of Design)
 - 2. Wenger Corporation.
 - 3. Staging Concepts.
 - 4. Or equal.

2.2 MOVABLE STAGE

- A. Product: 1800 Tuff-Deck Stage by Sico or equal.
- B. Configuration: As indicated on Drawings.
- C. Load Ratings:
 - 1. Uniformly Distributed Load: 125 psf.
 - 2. Sway Load: 5% of uniformly distributed load.
 - 3. Point Load: 337 lbs on a 2"x2" area.
- D. Stage Deck:
 - 1. Deck Construction: Constructed with durable 5/8" thick plywood.
 - 2. Deck Surface: Complement your deck surface with long wearing carpet or durable scratch-resistant black solid surface options.
 - a. Carpet color: As selected by Architect from manufacturer's full range.
 - 3. Unitized Steel Frame: Constructed with a rigid, one piece arc-welded unitized steel frame for long-lasting strength and durability. Deck is securely anchored to frame for structural integrity.
 - 4. Deck Edge: A vinyl coated steel deck edge wraps around the perimeter of the stage for long lasting wear and durability.
 - 5. Hook Fastener: Continuous hook fastener banding placed around the perimeter edges of decking allows for quick and easy attachment of skirting without any clips or pins.
- E. Stage Legs:
 - 1. Load Bearing Legs: Stage unit rests on 8 direct-to-floor load bearing legs that serve as points of contact to stabilize the stage in the open position. Stage unit is equipped with either single height, or dual height legs.
 - 2. Single Height Legs: Available in 8", 16", 24", and 32" fixed heights.
 - 3. Dual Height Legs: Telescoping legs allow for easy and convenient height adjustments. Equipped only on dual height stages.
 - 4. Height Adjustment Pins*: Allows for 8" height increments.

5. Swing Out Legs: For use when stage is set up at the maximum height. U-shaped leg helps pivot stage into the open position.
 6. Glides: Non-marring glides protect floors and dampen noise.
- F. Unit-to Unit Connectors:
1. Non-Tiered Connector:
 2. Permanently attached spring loaded yellow connector holds additional stage units securely together when at the same heights. No additional tools required.
 3. Tiered Riser Connector: Built-in black connectors secure additional stages together when units are at different heights. Stage decks slightly overlap in this setup to keep chair legs from sliding through. No additional chair stop is required.
- G. Ramp, Stairs, and Railings: Manufacturer's standard.
1. ADA compliant.
- H. Curtain Closures and Backdrops: Manufacturer's standard stage-drapery-fabric curtain closures with hanging accessories, as follows:
1. Skirting closures.
 2. Backdrop closure, 8 foot-high, with metal frame.
 3. Color: As selected by Architect from manufacturer's full range.
- I. Transport and Storage:
1. Self-Storing Mobile Unit: Designed to be a self-contained mobile unit for efficient single person set up and easy storage, resulting in considerable savings in labor and time. No need for additional transport carts, or heavy lifting.
 2. Folding for Transport & Storage: When stage is folded for transport, leg pivot points provide an over-center lock feature that holds the decks in the folded position. A flexible strap connects the folded halves to each other for added security
 3. Heavy Duty Casters: Two fixed and two swiveling heavy duty 5" non-marring rubber wheels protect floors, and are designed for long life.
 4. Yellow Wheel Frame: The painted yellow frame identifies the side of stage unit that contains the swiveling wheels.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine installation areas and mounting surfaces with Installer present, for compliance with manufacturer's installation tolerances including required clearances, floor level, location of blocking and anchoring reinforcements, and other existing conditions that may affect installation or performance.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Proceed with installation only after correction of unsatisfactory conditions.

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3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION - GENERAL

- A. Install manufactured units in accordance with manufacturer's recommendations, approved submittals, and in proper relationship with adjacent construction.

3.4 INSTALLATION OF STAGE

- A. Install manufactured units in location indicated to verify components are complete and operational. Adjust equipment until satisfactory results are achieved.

3.5 CLEANING AND PROTECTION

- A. Repair or replace defective work as directed by Architect upon inspection.
- B. Clean surfaces. Touch up marred finishes, or replace damaged components that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by manufacturer.
- C. Protect installed products from damage, abuse, dust, dirt, stain, or paint until completion of project. Do not permit use during construction.

END OF SECTION 116001

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes following roller window shades:
 - 1. Motorized operation.
- B. Related Sections include the following:
 - 1. Division 26 sections for electrical requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.
- B. Shop Drawings: Show location and extent of roller shades. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other work, operational clearances, and relationship to adjoining work.
- C. Samples for Initial Selection: For each colored component of each type of shade indicated.
 - 1. Include similar Samples of accessories involving color selection.
- D. Samples for Verification:
 - 1. Complete, full-size operating unit not less than 16 inches wide for each type of roller shade indicated.
 - 2. For the following products:
 - a. Shade Material: Not less than 3 inches square, with specified treatments applied. Mark face of material.
- E. Window Treatment Schedule: For roller shades. Use same designations indicated on Drawings.
- F. Product Certificates: For each type of roller shade, signed by product manufacturer.
- G. Qualification Data: For Installer.
- H. Product Test Reports: For each type of roller shade.

- I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of roller shade.
- J. Maintenance Data: For roller shades to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining roller shades and finishes.
 - 2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
 - 3. Operating hardware.

1.4 QUALITY ASSURANCE

- A. Comply with Title 19, Article 3-08.
- B. Installer Qualifications: Fabricator of products.
- C. Source Limitations: Obtain roller shades through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and listing approved by CSFM.
 - 1. Flame-Resistance Ratings: Passes NFPA 701.
- E. Product Standard: Provide roller shades complying with WCMA A 100.1.
- F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in factory packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same designations indicated on Drawings and in a window treatment schedule.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of roller shades that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Lifetime.
- B. Installer's Warranty: 1 year.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Rollers Shades: Before installation begins, for each size, color, texture, and pattern indicated, full-size units equal to 5 percent of amount installed, but not fewer than 2 units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Roller Shades: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
 - 1. MechoShade Systems, Inc. (Basis of Design)
 - 2. Draper Inc.
 - 3. Silent Gliss USA, Inc.
 - 4. Hunter Douglas.
 - 5. Or equal.

2.2 ROLLER SHADES

- A. Type: Motorized shades.
- B. Solar Shade Cloth: As indicated Drawings.

2.3 ACCESSORIES

- A. Roller Shade Pocket: For recessed mounting in acoustical tile, or drywall ceilings as indicated on the Drawings.
 - 1. Product: 1-1/2" by 6" clear anodized aluminum.
 - 2. Provide either extruded aluminum and or formed steel shade pocket, sized to accommodate roller shades, with exposed extruded aluminum closure mount, tile support and removable closure panel to provide access to shades.
 - a. Provide "Vented Pocket" such that there will be a minimum of four 1 inch diameter holes per foot allowing the solar gain to flow above the ceiling line.
 - 3. Pocket Accessories: As indicated on the Drawings.
- B. Fascia:
 - 1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.

2. Fascia shall be able to be installed across two or more shade bands in one piece.
3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.
5. Notching of Fascia for manual chain shall not be acceptable.

2.4 SHADE BAND

- A. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.
 1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for all shades within one room.
 2. Shade Band and Shade Roller Attachment:
 - a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Roller tubes less than 1.55 inch in diameter for manual shades, and less than 2.55 inches for motorize shades are not acceptable.
 - b. Provide for positive mechanical engagement with drive / brake mechanism.
 - c. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" spline mounting, without having to remove shade roller from shade brackets.
 - d. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
 - e. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

2.5 SHADE FABRICATION

- A. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.
- B. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch in either direction per 8 feet of shade height due to warp distortion or weave design. Fabricate hem as follows:
 1. Standard concealed hem bar.

2.6 COMPONENTS

- A. Access and Material Requirements:
 1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.

2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
 3. Use only Delrin engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester will not be acceptable.
- A. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.
 3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:
 - a. Individual Switch Control Station: Three-position, toggle-style, wall-switch-operated control station with open, close, and center off functions.
 - b. Group Control Station: Three-position, rocker-style, wall-switch-operated control station with open, close, and center off functions for single-switch group control.
 - c. Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features; isolated from voltage spikes and surges.
 4. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
 5. Operating Features:
 - a. Group switching with integrated switch control; single faceplate for multiple switch cutouts.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 122413

SECTION 22 0000 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. General Plumbing Requirements specifically applicable to all Division 22 Sections.
 - 2. Some piping material and installation instructions common to most piping systems.
 - 3. Grout.
 - 4. Plumbing Demolition (when indicated on the drawings).
 - 5. Equipment installation requirements common to equipment sections.
 - 6. Concrete bases.
 - 7. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene monomer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.

1.4 REFERENCES AND STANDARDS:

A. The editions recognized by latest *California Plumbing Code* of the following are hereby included in and made a part of Division 22:

- | | | |
|-----|-------|--|
| 1. | NFPA | National Fire Protection Association |
| 2. | UL | Underwriters' Laboratories, Inc. |
| 3. | NEMA | National Electrical Manufacturer's Association |
| 4. | NEC | National Electric Code |
| 5. | ASME | American Society of Mechanical Engineers |
| 6. | AWS | American Welding Society |
| 7. | ANSI | American National Standards Institute |
| 8. | AGA | American Gas Association |
| 9. | HI | Hydronics Institute |
| 10. | OSHA | Occupational Safety and Health Act |
| 11. | AWWA | American Water Works Association |
| 12. | CISPI | Cast Iron Soil Pipe Institute |

1.5 QUALITY ASSURANCE AND COORDINATION

- A. Electrical Characteristics for Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- B. All work to meet in-force local plumbing code. In the case of discrepancies between the project contract documents and the in-force local code, the most stringent shall govern.
- C. As NU FMO plumbing staff shall walk through and inspect all plumbing work prior to walls or ceilings being closed up, deficiencies shall be noted and given to the project manager in writing.
- D. Comply with most current edition of Northwestern University Design Standards.
- E. All materials and installations shall meet applicable FM Global requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

- A. Contractor shall coordinate the work of the different trades so that interference between piping, equipment, structural, and electrical work will be avoided. All necessary offsets in piping and ductwork, and all fittings, and other components, required to install the work properly shall be furnished complete in place at no additional cost.
- B. Unless otherwise stipulated under a particular heading, the following rules relative to responsibilities of the Contractors and Subcontractors will apply:

1. Make-up water piping connections shall be provided by the Plumbing Contractor to within five (5) feet of the required point of connection to the equipment and there terminated with a shut-off valve. Each trade shall make the final connection to the equipment it installs.
2. Ceiling access panels will be installed by the General Contractor at locations determined by the Plumbing Contractor.
3. The Plumbing Contractor or subcontractor shall install all roughing-in pertaining to his trade for each item of equipment furnished under another Section of the Specifications or by the Owner.
4. The Plumbing Contractor shall make final connections of equipment to rough-ins.

1.8 EQUIPMENT START-UP

- A. Start-up of all plumbing equipment shall be video-recorded by the plumbing contractor. Two DVD copies shall be turned over to the Owner's maintenance staff.

1.9 TESTING AND REPAIR

- A. All piping and ductwork systems shall be thoroughly cleaned and flushed prior to final testing.
- B. Pressure testing shall be completed for the following piping systems:
 1. Domestic water, sanitary and vent, storm and gas piping systems, and other systems as noted on the plans.
- C. All testing must be witnessed and accurately recorded noting methods of testing, times, dates, and results.
- D. Any damage as a result of tests shall be repaired or damaged materials replaced at no cost to the Owner.

1.10 FINAL COMPLETION

- A. All work shall be cleaned prior to issuance of Substantial Completion.
- B. Retouch or repaint factory painted prime and finish coats where scratched or damaged.
- C. Deliver any equipment as required by this Specification to Owner and obtained signed receipts of delivery.
- D. Clean equipment, restore damaged materials, and leave the Work in acceptable condition.
- E. Remove all site tools, equipment, surplus materials and rubbish continuously at no additional cost to the Owner.
- F. Contractor shall submit written certificates warranting each item of equipment.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS:

- A. All equipment and materials shall be furnished in strict accordance with the equipment named and according to Specification requirements. Each bid shall be based upon one of the materials or manufacturers specified.
- B. Equipment and materials specified shall be considered to have prior approval, but submittal for approval is required. Furnish construction drawings to other Contractors when required to coordinate construction.
- C. Where multiple manufacturers are named the drawings and specifications are based on the requirements and layouts for the equipment of the first named manufacturer. Any change required by the use of other named manufacturers such as revisions to foundations, bases, piping, controls, wiring, openings, and appurtenances shall be made by the Contractor at no additional cost to the Owner.

2.2 PIPE, TUBE, AND FITTINGS - GENERAL

- A. Refer to individual Division 22 Piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 GROUT

- A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION (When indicated on the drawings)

- A. Refer to applicable Division 01 Section covering cutting and patching and applicable Division 02 Section covering selective structure demolition for general demolition requirements and procedures.
- B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.
- C. All unused waste, water and vent that is no longer in service shall be removed from ceilings, walls and floors. No dead piping will be allowed to stay. Underground piping shall also be removed. If piping cannot be removed underground it shall be capped at the main and the pipe shall be pumped and filled with a flowable fill.

- D. A MOP will be required when filling abandoned sewers, old water mains or any plumbing piping that is buried in the ground.
- E. Before abandoning any plumbing piping underground, the piping shall be inspected, video recorded, mapped on an as built and FMDC and FMO shall approve abandoning the piping.
- F. After completion of all work, all of the sewer systems involved with the project in their entirety, shall be thoroughly cleaned out to remove all grit, or other foreign matter. This shall include the use of a camera and recording to a flash drive or DVD and a copy of the recording included with the close out documents.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. All materials and/or equipment shall be installed per manufacturer's recommendations and instructions.
- B. When temporary water is required, an approved backflow device shall be used and testing reports from device shall be sent to FMO plumbing foreman for verification.
- C. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- D. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- E. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- G. Piping shall not project beyond walls or steel lines nor shall it hang below slabs more than is absolutely necessary. Particular attention shall be paid to the required clearances.
- H. Offset piping where required to avoid interference with other work, to provide greater headroom or clearance, or to conceal pipe more readily. Offsets shall be properly drained or trapped where necessary.
- I. Provide swing joints and expansion bends wherever required to allow the piping to expand without undue stress to connections or equipment.
- J. Exposed piping around fixtures or in other conspicuous places shall not show tool marks at fittings.
- K. Isolate pipe from the building construction to prevent transmission of vibration to the structure and to eliminate noise.
- L. Install piping such that any equipment connected to piping may be removed by disconnecting two (2) flanges or unions and removing only one or two pipe sections. All equipment shall have bolted or screwed flanges or unions at pipe connections.

- M. Install fittings for changes in direction and branch connections. T-drill system for mechanically formed tee connections and couplings, and Victaulic hole cut piping system are not allowed.
- N. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.
- O. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- P. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- Q. Install piping to permit valve servicing.
- R. Install piping at indicated slopes.
- S. Install piping free of sags and bends.
- T. Install piping to allow application of insulation.
- U. Eccentric reducing couplings shall be provided in all cases where air or water pockets would otherwise occur due to a reduction in pipe size.
- V. Cap and plug all openings in pipes during construction with suitable metal plugs or cap to keep out dirt and rubbish until equipment is connected.
- W. Install drains, consisting of a tee fitting, NPS 3/4 full port-ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- X. Select system components with pressure rating equal to or greater than system operating pressure.
- Y. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- Z. Verify final equipment locations for roughing-in.
- AA. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- BB. Provide proper access to materials and equipment that require inspection, repair, service, or maintenance.
- CC. Minimum service access size for materials equipment/components above ceilings shall be 24" square.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.4 PIPING CONNECTIONS

- A. Pipe sizes indicated shall be carried full size to equipment served. Any change of size to match equipment connection shall be made within one foot of the equipment. At temperature control valves with sizes smaller than connected lines, reduction shall be made immediately adjacent to valves.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install Plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Install dowel rods to connect concrete base to concrete floor.
 - 2. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete"

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor Plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.8 GROUTING

- A. Mix and install grout for Plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 22 0000

SECTION 22 0517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Stack-sleeve fittings.
 - 3. Sleeve-seal systems.
 - 4. Sleeve-seal fittings.
 - 5. Grout.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Smith, Jay R. Mfg. Co.
 - 2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
- B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.
 - 3. Metraflex Company (The).
 - 4. Pipeline Seal and Insulator, Inc.
 - 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel or stainless steel.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, or stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Presealed Systems.
- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
 - 1. Install fittings that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
 - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
 - 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.
 - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 5. Using grout, seal the space around outside of stack-sleeve fittings.

- B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than [NPS 6 (DN 150)]: Cast-iron wall sleeves or galvanized-steel- pipe sleeves.
 - b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves or galvanized-steel- pipe sleeves.
 - 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system or galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves with sleeve-seal system or galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 - 3. Concrete Slabs-on-Grade:

- a. Piping Smaller than NPS 6 (DN 150): Cast-iron floor sleeves with sleeve-seal system, galvanized-steel-pipe sleeves with sleeve-seal system, or Sleeve-seal fittings.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 (DN 150) and Larger: Cast-iron floor sleeves with sleeve-seal system, galvanized-steel-pipe sleeves with sleeve-seal system, or galvanized- steel-pipe sleeves.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
4. Concrete Slabs above Grade:
- a. Piping Smaller Than NPS 6 (DN 150) : Galvanized-steel-pipe sleeves, stack- sleeve fittings, or Sleeve-seal fittings.
 - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves or stack-sleeve fittings.
5. Interior Partitions:
- a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 22 0517

SECTION 22 0523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Bronze ball valves.
2. Bronze swing check valves.
3. Iron swing check valves.
4. Iron swing check valves with closure control.
5. Bronze globe valves.
6. Iron globe valves.
7. Chainwheels.

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.3 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.4 QUALITY ASSURANCE

- A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.
- C. To assure uniformity and compatibility, all grooved end valves and adjoining couplings shall be supplied by the same manufacturer.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 - 2. Handwheel: For valves other than quarter-turn types.
 - 3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
 - 4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- E. Valves in Insulated Piping: With 2-1/4 inch stem extensions and the following features:
 - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
- F. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Solder Joint: With sockets according to ASME B16.18.
 - 3. Threaded: With threads according to ASME B1.20.1.
 - 4. Grooved: With grooves according to ANSI/AWWA C606.

2.2 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Ball Valves with Stainless-Steel Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc. (Apollo)
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: 316 Stainless Steel.
 - i. Ball: 316 Stainless Steel.
 - j. Port: Full.

2.3 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc. (Apollo)
2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

2.4 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc. (Apollo)
2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged.
 - f. Trim: Bronze.
 - g. Gasket: Asbestos free.

2.5 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:

1. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged.
 - f. Trim: Bronze.
 - g. Gasket: Asbestos free.
 - h. Closure Control: Factory-installed, exterior lever and spring.

2.6 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc. (Apollo)
2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem and Disc: Bronze.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable iron.

2.7 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc. (Apollo)
2. Description:
 - a. Standard: MSS SP-85, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Packing and Gasket: Asbestos free.

2.8 CHAINWHEELS

A. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
2. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve. Include zinc coating.
3. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install swing check valves for proper direction of flow and in horizontal position with hinge pin level.
- F. Install grooved end valves in accordance with the manufacturer's guidelines and recommendations. A representative shall provide on-site training for contractor's field personnel in the installation of grooved end valves. Factory-trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

3.2 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball valves.
 - 2. Throttling Service: Globe or ball valves.
 - 3. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
 - b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring.
 - c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve- end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve- end option is indicated in valve schedules below.
 - 3. For Steel Piping, NPS 2 and Smaller: Threaded ends.

4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.4 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125, bronze disc.
3. Ball Valves: Two piece, full port, 316 stainless steel with bronze trim.
4. Bronze Swing Check Valves: Class 125, bronze disc.
5. Bronze Globe Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Swing Check Valves: Class 125, metal seats.
3. Iron Swing Check Valves with Closure Control: Class 125, lever and spring.
4. Iron Globe Valves: Class 125.

END OF SECTION 22 0523

SECTION 22 0529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 220516 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
3. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
 1. Trapeze pipe hangers.
 2. Metal framing systems.
 3. Pipe stands.
 4. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 1. Detail fabrication and assembly of trapeze hangers.
 2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Stainless-Steel Pipe Hangers and Supports:
 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U- bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.
 - c. Powerstrut
 - d. Unistrut Corporation; Tyco International, Ltd.
2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturred lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washers made of carbon steel.
7. Metallic Coating: Electroplated zinc or mill galvanized.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa), ASTM C 552, Type II cellular glass with 100-psig (688-kPa), or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
 - 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - 2. Base: Stainless steel.
 - 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous- thread rods.
 - 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless- steel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand:
 - 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 - 2. Bases: One or more; plastic.
 - 3. Vertical Members: Two or more protective-coated-steel channels.
 - 4. Horizontal Member: Protective-coated-steel channel.
 - 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

- F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural- steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.8 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon- steel shapes.

2.9 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:

1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.
- G. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- J. 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.
- K. Install lateral bracing with pipe hangers and supports to prevent swaying.
- L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- O. Insulated Piping:
1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
 - d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
 - e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC- PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in applicable Division 9 section(s).
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon- steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2- 1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb (340 kg).
 - b. Medium (MSS Type 32): 1500 lb (680 kg).
 - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1- 1/4 inches (32 mm).
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- S. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 0529

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Pipe labels.
 - 3. Valve tags.
 - 4. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

1.5 WORK INCLUDED

- A. Furnish and install nameplates, valve tags, valve charts, and pipe markers on all Plumbing equipment, and piping.
- B. Provide nameplates with the unit number and service designation on all plumbing equipment.

- C. Indicate all valve tag numbers on Record Drawings and submit framed under glass valve tag charts including valve service and location.
- D. Install color coded ceiling tacks in acoustical tile ceilings or color coded tape on ceiling grid to identify location of equipment, valves and dampers that require regular maintenance or are part of a life safety system (fire dampers, smoke dampers, sprinkler valves or main isolation valves). Concealed fire protection valves shall be marked by red label triangles (3" equilateral) and circle dots (1" diameter). Triangles shall be placed on the wall nearest the valve with the apex pointing toward the ceiling tile. Dots shall be placed on border of ceiling tile.
- E. Provide underground plastic pipe markers 6 to 8 inches below finish grade, directly above buried pipes.
- F. Prepare valve charts and frame under glass. All valves and the tag numbers shall be shown on the Record As-Built Drawings.
- G. Provide valve computer data base to match chart.
- H. Prepare and install exterior protected brass plaques indicating underground service entrances.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Acceptable manufactures contingent on compliance with the specification.
 - 1. Seton
 - 2. Brady Corporation
 - 3. Marking Services Incorporated

2.2 EQUIPMENT NAMEPLATES

- A. Equipment nameplates shall be 3" x 6" long, 0.02" aluminum with a black enamel background with engraved natural aluminum letters similar to Seton Style 2065-20. Nameplate shall have pressure sensitive taped backing.
- B. The nameplate shall contain the unit or equipment designation ("AHU" for air handling unit, "P" for circulating pump, etc.), unit number and area or system served.
- C. Nameplates for exterior equipment shall be applied with waterproof adhesive.

2.3 PIPE IDENTIFICATION AND VALVE TAGS

- A. All piping, except that piping which is within inaccessible chases, shall be identified with semi-rigid plastic identification markers equal to Seton Setmark pipe markers.
 - 1. Direction of flow arrows are to be included on each marker.
 - 2. Each marker background shall be appropriately color coded with a clearly printed legend to identify the contents of the pipe in conformance with the "Scheme for the Identification of Piping Systems" (ASME A13.1-1981).

3. Setmark snap-around markers shall be used for overall diameters up to 6" and strap- around markers shall be used above 6" overall diameters.
4. Markers shall be located:
 - a. Adjacent to each valve
 - b. At each branch
 - c. At each cap for future
 - d. At each riser takeoff,
 - e. At each pipe passage through wall (each side)
 - f. At each pipe passage at 20' – 0" intervals maximum.
 - g. At each piece of equipment.
 - h. At all access doors.
 - i. A minimum of one (1) marker shall be provided at each room.
5. Under ground pipe markers:
 - a. Provide detectable tape on all underground piping:
 - b. Labels shall be color coded and labeled the same as indoors.

B. Valve tags

1. All valves shall be designated by distinguishing numbers and letters carefully coordinated with a valve chart. Valve tags shall include what room(s) the valve serves and piece of equipment served.
2. Valve tags shall be color coded 0.032" anodized aluminum tags, with engraved letters similar to Seton S Type 250-BL or approved equal.
 - a. HVAC tags shall be round 2" diameter, similar to Seton 15426.
 - b. Plumbing tags shall be square 2" x 2" similar to Seton 42769.
 - c. Fire Protection tags shall be square 2" x 2" similar to Seton 42769 RED.
 - d. Lettering shall be ¼" high for type service and ½" for valve number. Tag shall indicate service and valve number.
 - e. Each service shall be a different color.
3. Tag shall be attached to valves with chain similar to Seton No 16 stainless steel jack chain.
4. Whenever a valve is above a hung ceiling, the valve tag shall be located immediately above the hung ceiling.
5. Provide a tag for every valve except:
 - a. Perimeter radiation shut-off valves that are located at the finned tube radiation element within the accessible (from the space) heating enclosure

C. Furnish a minimum of two (2) typed valve lists

1. Each framed under glass or Plexiglas. Each chart shall be enclosed in an approved 0.015" thick plastic closure for permanent protection.
2. Valve numbers shall correspond to those indicated on the Record Drawings and on the printed valve lists.
3. The printed list shall include the valve number, location and purpose of each valve.
4. It shall state other necessary information such as the required opening or closing of another valve when one valve is to be opened or closed.
5. Printed framed valve lists shall be displayed in each Mechanical Room or in a location designated by Northwestern University.

D. Valve data base.

1. Provide a valve data base for all valves to operate on the building computer.
2. Every valve shall include:
 - a. Tag Number
 - b. Service (Hot water, Chilled water, Sprinkler, etc.)
 - c. Size
 - d. Operation
 - e. Location
 - f. Manufacture
 - g. Model number
 - h. Submittal reference

2.4 UTILITY ENTRANCE DESIGNATIONS

- A. Provide a brass wall plaque, minimum 0.020" thickness, secured to the exterior wall just above the grade line for all buried service entrances or exits. Samples are: Water Service Below; Gas Service Below; Sanitary Sewer Below; Storm Sewer Below; Irrigation Water Below; etc.
- B. Ceiling Tacks or Tape.
- C. Provide steel color coded 3/4 inch diameter ceiling tacks in acoustical tile ceilings or color coded tape applied to ceiling grid to locate equipment, valves or dampers that require regular maintenance or are part of a Life Safety System.
- D. The tacks or tapes shall be color codes as follows:
 1. Yellow – HVAC
 2. Red – Life Safety (fire dampers, sprinkler valves, etc.)
 3. Green - Plumbing Valves.
 4. Blue – Heating/Cooling Valves.

PART 3 - EXECUTION

3.1 PREPARATION

- A. All surfaces shall be cleaned and insulated (if applicable) prior to installing any identification.
- B. Exterior surfaces of outdoor equipment shall be dry and prepared to accept the specified identification.

3.2 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion. Seal with clear lacquer.
- B. Install valve tags with chain.
- C. Install plastic pipe markers in accordance with manufacturer's Instructions.

- D. Install plastic tape markers complete around pipe in accordance with manufacturer's instructions.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Identify air handling units, pumps, domestic hot water heaters, fire pumps, heat transfer equipment tanks, water treatment devices, etc. with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Install detector tape on all under ground services in accordance with the manufactures recommendations.
- I. Identify thermostats relating to air handling equipment serving multiple spaces.
- J. Identify valves in main and branch piping with valve tags.
- K. Tag automatic controls, instruments and relays. Key to control schematic.
- L. Identify piping, concealed or exposed, with pipe markers or where buried using plastic tape pipe markers. Use tags on piping $\frac{3}{4}$ inch diameter and smaller. Identify service, flow direction and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION 22 0553

SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Insulation Materials:
 - a. Flexible elastomeric.
 - b. Mineral fiber.
 - c. Polyolefin.
- 2. Insulating cements.
- 3. Adhesives.
- 4. Mastics.
- 5. Sealants.
- 6. Factory-applied jackets.
- 7. Field-applied fabric-reinforcing mesh.
- 8. Field-applied jackets.
- 9. Tapes.
- 10. Securements.
- 11. Corner angles.

B. Related Sections include the following:

- 1. Division 23 Section "HVAC Insulation."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittal:

- 1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.

C. Shop Drawings:

- 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
- 2. Detail attachment and covering of heat tracing inside insulation.

3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.
8. Detail field application for each equipment type.

D. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test- response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Micro-Lok.
 - b. Knauf Insulation; 1000 Pipe Insulation.
 - c. Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

H. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armacell LLC; Tubolit.
 - b. Nomaco Inc.; IMCOLOCK, IMCOSHEET, NOMALOCK, and NOMAPLY.
 - c. RBX Corporation; Therma-cell.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Insulco, Division of MFS, Inc.; SmoothKote.
 - b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
 - c. Rock Wool Manufacturing Company; Delta One Shot.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aero seal.
 - b. Armacell LCC; 520 Adhesive.
 - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
 - d. RBX Corporation; Rubatex Contact Adhesive.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Chemical Company (The); 739, Dow Silicone.
 - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Speedline Vinyl Adhesive.
 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.
 - d. Marathon Industries, Inc.; 590.
 - e. Mon-Eco Industries, Inc.; 55-40.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Products, Division of ITW; CP-10.
- b. Foster Products Corporation, H. B. Fuller Company; 35-00.
- c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
- d. Marathon Industries, Inc.; 550.
- e. Mon-Eco Industries, Inc.; 55-50.

2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F.
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Products, Division of ITW; CP-76.
- b. Foster Products Corporation, H. B. Fuller Company; 30-45.
- c. Marathon Industries, Inc.; 405.
- d. Mon-Eco Industries, Inc.; 44-05.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
5. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave, for equipment and pipe.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Products Corporation, H. B. Fuller Company; Mast-A-Fab.
 - b. Vimasco Corporation; Elastafab 894.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto PVC Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: White.
 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

- a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - b. Compac Corp.; 110 and 111.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
 - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
 - b. Compac Corp.; 130.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
 - d. Venture Tape; 1506 CW NS.
2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.

5. Elongation: 500 percent.
 6. Tensile Strength: 18 lbf/inch in width.
- D. PVDC Tape: White vapor-retarder PVDC tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.
 2. Width: 3 inches.
 3. Film Thickness: 4 mils.
 4. Adhesive Thickness: 1.5 mils.
 5. Elongation at Break: 145 percent.
 6. Tensile Strength: 55 lbf/inch in width.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Division 07 Section "Penetration Firestopping" and fire- resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless- steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 MINERAL-FIBER INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 POLYOLEFIN INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

D. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch- circumference limit

allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.

5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.9 FINISHES

- A. Equipment and Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, locations of welded strainers, locations of threaded valves, and locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 1. Drainage piping located in crawl spaces.
 2. Underground piping.
 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold and Non-potable Cold Water: Insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1/2 inch thick for pipe sizes less than 1-1/2 inches, 1 inch thick for pipe sizes 2 inches and greater
 - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick for pipe sizes less than 1- 1/2 inches, 1 inch thick for pipe sizes 2 inches and greater
 - 3. Polyolefin: 1/2 inch thick for pipe sizes less than 1-1/2 inches, 1 inch thick for pipe sizes 2 inches and greater

- B. Domestic Hot, and Re-circulated Hot Water and Tempered Water: Insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - 3. Polyolefin: 1 inch thick.

- C. Horizontal Stormwater and Emergency Drain: Insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - 3. Polyolefin: 1 inch thick.

- D. Roof Drain and Emergency Drain Bodies: Insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch Insert thickness thick.
 - 3. Polyolefin: 1 inch thick.

- E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops at lavatories shall be insulated and finished with Truebro Model No. 102 "Lav-Guard" or Brocar "Trap-Wrap" white insulation kit.

- F. Sanitary Waste Piping Where Heat Tracing Is Installed, insulation shall be:
 - 1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

3.13 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Domestic Cold, Hot, and Recirculated Hot Water: Insulation shall be one of the following:
 - 1. Flexible Elastomeric: 2 inches thick.
 - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

- B. Sanitary Waste Piping Where Heat Tracing Is Installed: Insulation shall be:
 - 1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

3.14 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

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B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:

1. PVC: 20 mils thick.

3.15 Aluminum, Smooth or Corrugated or Stucco Embossed: 0.016 inch thick.

END OF SECTION 22 0700

SECTION 22 1118 - DOMESTIC WATER DISTRIBUTION SYSTEM

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. Under-building slab supply, and aboveground domestic water supply and recirculation pipes, tubes, fittings, and certain specialties inside the building from 1'-0" above finished floor or 1'-0" inside the exterior wall as shown on the drawings, and as coordinated with the related work of Division 33.
2. Flexible connectors.
3. Piping encasement.
4. Water meters.
5. Application of valves.

B. Related Sections:

1. Division 33 Section "Facility Water Distribution Piping" for water-service piping outside the building from the source to a point 1'-0" above finished floor or 1'-0" inside the exterior wall of the building as shown on the drawings.
2. Division 22 0523 "General Duty Valves for Plumbing Piping"
3. Section 22 0000 "Common Work Results of Plumbing."
4. Section 22 2114 "Plumbing Specialties."
5. Section 22 4000 "Plumbing Fixtures."
6. Section 22 4500 "Plumbing Equipment."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control reports.
- C. For any systems requiring State code pre-approval, provide letters from the State for same.

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- D. Documentation that proposed products meet California Health and Safety Code 116875 (AB 1953) - 2010, for 25% low lead content of piping, pipe fittings, and faucets for water intended for human consumption.
- E. At closeout, Northwestern University Maintenance Requirement Forms, see Division 01 for more information.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with California Health and Safety Code 116875 (AB 1953) - 2010, for 25% low lead content of piping, pipe fittings, and faucets for water intended for human consumption, and NSF/ANSI Standard 61, including Annex G-2010 - Drinking Water System Components - Low Lead Content Requirement.
- C. To assure uniformity and compatibility of piping components in grooved end piping systems, all grooved products utilized shall be supplied by the same manufacturer.
- D. All grooved couplings shall be installed strictly according to grooved manufacturer's instructions including torque verification and specific lubrication as published.
- E. Flexible connectors shall be installed according to the manufacturer's instructions, with any adjacent special pipe support/guiding required.
- F. Comply with FM Global requirements for cross connections, and for any pressure reducing valves for fire protection service.

1.5 SPECIAL WARRANTIES

- A. Five (5) years, see Division 01 for more information.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
 - 1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
 - 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 - 4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and- socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

5. Grooved-End Copper Fittings: ASTM B 75 copper tube, or ASTM B 152 wrought copper, with copper tubing sized grooved ends designed to accept grooved couplings. Flaring of tube and fitting ends to IPS dimensions is not permitted.
6. Grooved-End-Tube Couplings: Rigid pattern, unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves: 2" through 8": Installation ready rigid coupling with Grade EHP/EPDM gaskets (unless noted otherwise herein) rated for maximum 250 deg F for use with housing, and steel bolts and nuts. Victaulic Style 607.
7. Grooved-End-Tube Mechanical Tube Fittings: Copper-tube dimensions and design similar to AWWA C606. Bronze upper housing and copper-colored enamel coated ductile iron lower housing, threaded outlet and locating collar, EPDM synthetic rubber gasket suit able for hot and cold water, and bolts and nuts. Victaulic Style 622.

2.3 DUCTILE-IRON PIPE AND FITTINGS (For 3" and Larger Pipe Sizes)

A. Mechanical-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.

2.4 GALVANIZED STEEL PIPE AND FITTINGS (Only for Limited Repair of Existing Galvanized Sections, and Joint Types and Supports to Match Adjacent Existing Similar Piping, and 6" and larger sizes only).

A. Galvanized-Steel Pipe: *ASTM A 53/A 53M, Standard Weight. Include ends matching existing joining method(s).*

1. *Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless steel pipe.*
2. *Galvanized, Gray-Iron Fittings: ASME B16.4, Class 125, standard pattern.*
3. *Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball- and-socket, metal-to-metal, with bronze seating surfaces.*
4. *Flanges: ASME B16.1, Class 125, cast iron.*

2.5 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813. Shall be Lead free NSF/ANSI 61 compliant.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general- duty brazing unless otherwise indicated. Shall be Lead free NSF/ANSI 61 compliant.
- E. Flux: ASTM B 813, water flushable.
- F. Pipe Thread Tape: Food grade commercial duty pipe thread sealant tape only.

2.6 TRANSITION FITTINGS

- A. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- B. Sleeve-Type Transition Coupling: AWWA C219.

2.7 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Flanges:
 - 1. Description:
 - a. Factory-fabricated, bolted, companion-flange assembly.
 - b. Pressure Rating: 150 psig.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder- joint copper alloy and threaded ferrous.
- C. Dielectric-Flange Kits:
 - 1. Description:
 - a. Nonconducting materials for field assembly of companion flanges.
 - b. Pressure Rating: 150 psig.
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.
 - e. Washers: Phenolic with steel backing washers.
- D. Dielectric Couplings:

1. Description:
 - a. Galvanized-steel coupling.
 - b. Pressure Rating: 300 psig at 225 deg F.
 - c. End Connections: Female threaded.
 - d. Lining: Inert and noncorrosive, thermoplastic.

E. Dielectric Nipples:

1. Description:
 - a. Electroplated steel nipple complying with ASTM F 1545.
 - b. Pressure Rating: 300 psig at 225 deg F.
 - c. End Connections: Male threaded or grooved.
 - d. Lining: Inert and noncorrosive, propylene.

2.8 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
2. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
2. End Connections NPS 2 (DN 50) and Smaller: Threaded stainless steel pipe nipple.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged stainless steel pipe nipple.

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flex-Hose.
2. Flexicraft.
3. Hispan.
4. Flex Precision.

3.1 JOINT CONSTRUCTION

- A.** Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B.** Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C.** Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D.** Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter. Shall be Lead free NSF/ANSI 61 compliant.
- E.** Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook." Shall be Lead free NSF/ANSI 61 compliant.
- F.** Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.
- G.** Joint Construction for Grooved-End, Ductile-Iron Piping: Make radius cut joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- H.** Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- I.** Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

- J.** Grooved Joints for Copper Piping: Roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. A representative shall provide on-site training for contractor's field personnel. Contractor shall remove and replace any improperly installed products.

3.2 VALVE INSTALLATION

- A.** General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations. Shall be Lead free NSF/ANSI 61 compliant.
- B.** Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 and smaller. Use OS&Y or NRS gate valves for piping NPS 2-1/2 and larger.
- C.** Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
 - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
 - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- D.** Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.
- E.** For isolation valves at water heaters, install valves that relieve heater pressure when closed.

3.3 TRANSITION FITTING INSTALLATION

- A.** Install transition couplings at joints of dissimilar piping.
- B.** Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition [fittings] [or] [unions].
- C.** Transition Fittings in Underground Domestic Water Piping:
 - 1. NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. NPS 2 and Larger: Sleeve-type coupling.

3.4 DIELECTRIC FITTING INSTALLATION

- A.** Install dielectric fittings in piping at connections of dissimilar metal piping and tubing. Shall be Lead free NSF/ANSI 61 compliant.
- B.** Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.
- C.** Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

- D.** Dielectric Fittings for NPS 5 to NPS 6: Use dielectric flange kits.

3.5 FLEXIBLE CONNECTOR INSTALLATION

- A.** Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.
- B.** Install bronze-hose flexible connectors in copper domestic water tubing.
- C.** Install stainless-steel-hose flexible connectors in non-copper domestic water piping.

3.6 WATER METER INSTALLATION

- A.** Rough-in domestic water piping, and install water meter as indicated on the drawings according to AWWA M6 and the utility company's requirements.
- B.** Install water meters with shutoff valves on water-meter inlet and outlet. Provide a valved bypass around meter only if required by the utility company. Support meters, valves, and piping on brick or concrete piers.
- C.** *Install remote registration system according to standards of University, utility company, and of authorities having jurisdiction.*

3.7 HANGER AND SUPPORT INSTALLATION

- A.** Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - 3. Base of Vertical Piping: MSS Type 52, spring hangers.
- B.** Support vertical piping and tubing at base and at each floor.
- C.** Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D.** Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
- E.** Install supports for vertical copper tubing every 10 feet.

F. Install hangers for ductile iron piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3: 12 feet with 1/2-inch rod.
2. NPS 4: 12 feet with 5/8-inch rod.
3. NPS 6: 12 feet with 3/4-inch rod.
4. NPS 8 and Larger: 12 feet with 3/4-inch rod.

G. Install supports for vertical ductile iron piping every 15 feet.

3.8 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to water-service piping at a point 1'-0" above finished floor or 1'-0" inside the exterior wall, as shown on the drawings, with a shutoff valve using a transition fitting to join dissimilar piping materials then extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.9 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction, FMDC and FMO.
2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Re-inspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for re-inspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, minimum of 100 psi, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.11 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.12 CLEANING

A. Clean and disinfect potable domestic water piping as follows (and in accordance with local code and jurisdiction):

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.13 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Under-building-slab, domestic water piping, NPS 2 1/2 and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type K; no joints allowed under floor slabs.

D. Under-building-slab, domestic water piping, NPS 3 and larger, shall be the following:

1. Ductile Iron; with ductile iron fittings, and mechanical joints.

E. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; cast or wrought copper solder-joint fittings; and soldered joints. Shall be Lead Free NSF/ANSI 61 compliant.

F. Aboveground domestic water piping, NPS 2 1/2, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; cast or wrought copper braze joint fittings; and brazed joints. Shall be Lead Free NSF/ANSI 61 compliant.
2. Hard copper tube, ASTM B 88, Type L; grooved, with matching fittings; and roll grooved joints. Shall be Lead Free NSF/ANSI 61 compliant.

G. Aboveground domestic water piping, NPS 3 and 4, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; cast or wrought copper braze-joint fittings; and brazed joints. Shall be Lead Free NSF/ANSI 61 compliant.
2. Hard copper tube, ASTM B 88, Type L; grooved, with matching fittings; and roll grooved joints. Shall be Lead Free NSF/ANSI 61 compliant.
3. Ductile Iron; with ductile iron fittings, and mechanical or grooved joints. Shall be Lead Free NSF/ANSI 61 compliant.

H. Aboveground domestic water piping, NPS 6 and Larger, shall be the following:

1. Ductile Iron; with ductile iron fittings, and mechanical or grooved joints.
2. Galvanized pipe with mechanical joints.

3.14 VALVE SCHEDULE (Including Access to Same)

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller. Use OS&Y or NRS gate valves or ball valves with flanged ends for piping NPS 2-1/2 and larger (ball valves only to 3"). Shall be Lead Free NSF/ANSI 61 compliant.
2. Throttling Duty: Use ball valves for piping NPS 2 and smaller. Shall be Lead Free NSF/ANSI 61 compliant.
3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
4. Drain Duty: Hose-end drain valves. Shall be Lead Free NSF/ANSI 61 compliant.
5. Faucets and fixtures, such as emergency showers, eyewashes, dishwashers, and autoclaves, shall have local shutoff valves within 5' of the faucet/fixture. Valves must be readily accessible. Shall be Lead Free NSF/ANSI 61 compliant.
6. Shut-off isolation valves shall be provided on the branch lines no more than 18" off of the main lines or risers. Additional shut-off isolation valves may be needed further down the branch lines also, and are to be provided to the satisfaction of the University. Shall be Lead Free NSF/ANSI 61 compliant.

B. Iron grooved-end valves may be used with grooved-end piping. Shall be Lead Free NSF/ANSI 61 compliant.

C. Access panels shall be provided for any plumbing valves that may be in walls or in-accessible ceilings. Access panels shall be a minimum of 12" x 12".

END OF SECTION 22 1118

SECTION 22 1316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes sanitary drainage inside the building up to a point 5'-0" outside the building and vent piping inside the building including:
 - 1. Pipe and fittings.
 - 2. Special pipe fittings.

1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 SUBMITTALS

- A. LEED Submittal:
 - 1. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.
- B. Field quality-control inspection and test reports.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-DWV" for plastic drain, waste, and vent piping; and "NSF- drain" for plastic drain piping.

1.6 FIELD CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify the University no fewer than seven days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without the University's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.
 1. Gaskets: ASTM C 564, rubber.
- B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301.
 1. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - b. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
- C. Schedule 40 PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
 1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
 2. Solvent Cement and Adhesive Primer:
 - a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.
 1. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.
 2. Pressure Fittings:
 - a. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
 - b. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball- and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
 - c. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
 - d. Cast-Iron Flanges: ASME B16.1, Class 125.
 - e. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
- E. CPVC Drainage Pipe and Fittings: ASTM F 2618 pipe and drainage-pattern fittings.

1. Acceptable Manufacturers: Charlotte Chemdrain (Basis of Design)
2. Solvent Cement for Joining CPVC Piping: ASTM F 493. Include primer according to ASTM F 656.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- C. Aboveground, soil & waste piping shall be:
 1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
- D. Aboveground, vent piping shall be one of the following:
 1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- E. Underground, soil, waste, and vent piping shall be one of the following:
 1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
 2. Solid-wall Schedule 40 PVC pipe, PVC socket fittings, and solvent-cemented joints.
- F. Sewage pump or sump pump discharge piping shall be one of the following:
 1. Solid-wall Schedule 40 PVC pipe, PVC socket fittings, and solvent-cemented joints.
 2. Schedule 40 galvanized steel pipe with screwed galvanized cast iron drainage fittings.
- G. Single-Wall, Chemical-Waste Sewerage Piping: Use the following piping materials for each size range:
 1. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): CPVC drainage pipe and fittings and solvent-cemented joints.
- H. Underground, Double-Containment, Chemical-Waste Sewerage Piping: Use the following piping materials for each size range:
 1. NPS 2 to NPS 12 (DN 50 to DN 300): CPVC double-containment drainage pipe and fittings.

- I. Aboveground Chemical-Waste Piping: Use the following piping materials for each size range:
 - 1. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): CPVC drainage piping and solvent-cemented joints.
- J. PVC piping may not be installed in a return air plenum for any of the above piping applications unless piping is completely insulated in fire retardant insulation rated for return air plenums.

3.3 PIPING INSTALLATION

- A. Site sanitary sewer piping to a point 5'-0" outside the building is specified in Division 33 Section "Facility Sanitary Sewers."
- B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- C. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- D. Install CPVC drainage piping according to ASTM D 2321 and ASTM F 1668.
- E. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- F. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- G. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Sanitary Drains: 2 percent downward in direction of flow for piping NPS 2 and 1 percent downward in direction of flow for piping NPS 3 and larger.
 - 2. Vent Piping: Slope toward vertical fixture vent or toward vent stack.
- H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- I. Install PVC soil and waste drainage and vent piping according to ASTM D 2665 and ASTM D 2321.
- J. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

- K. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Common Work Results for Plumbing".
- L. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Common Work Results for Plumbing".
- M. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Common Work Results for Plumbing".

3.4 VALVE INSTALLATION

- A. General-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves: Install shutoff valve on each sewage pump or sump pump discharge.
- C. Check Valves: Install swing check valve, downstream from shutoff valve, on each sewage pump or sump pump discharge.

3.5 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
 - 2. Hubless Joints: Make with rubber gasket and sleeve or clamp.
- C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

- C. Support vertical piping and tubing at base and at each floor.
- D. Install piping hangers and rod diameters per MSS-SP-69
- E. Install supports for vertical cast-iron soil piping every 15 feet.
- F. Install supports for vertical steel piping every 15 feet.
- G. Install supports for vertical CPVC piping every 48 inches.
- H. Install supports for vertical PVC piping every 48 inches.
- I. Support piping and tubing according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

- A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- B. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Sanitary Waste Piping Specialties."
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Sanitary Waste Piping Specialties."
 - 4. Equipment: Connect drainage piping or pump discharge piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures. Inspections shall be made by FMO plumbing staff prior to closing-in of walls.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test drainage piping on completion of roughing in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.9 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PROTECTION

- A. Exposed PVC Piping: Protect PVC piping exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 22 1316

SECTION 22 1319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:
 - 1. Cleanouts.
 - 2. Floor drains.
 - 3. Through penetration firestop assemblies.
 - 4. Roof flashing assemblies.
 - 5. Miscellaneous sanitary drainage piping specialties.
 - 6. Flashing materials.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Josam Company.
 - 2. Smith, Jay R. Mfg. Co.
 - 3. Tyler Pipe; Wade Div.
 - 4. Zurn Plumbing Products Group.
- B. Exposed Horizontal Cleanouts, HCO:
 - 1. Standard: ASME A112.36.2M for cast iron for cleanout test tee.

2. Size: Same as connected drainage piping
3. Body Material: Hubless, cast-iron soil pipe test tee as required matching connected piping.

C. Floor Cleanouts, FCO:

1. Standard: ASME A112.36.2M for adjustable housing cleanout.
2. Size: Same as connected branch.
3. Coated cast iron internal gasketed ABS cleanout plug and adjustable ABS housing.
4. Medium-duty scoriated secured round satin finish Nikaloy top.

D. Wall Cleanouts, WCO:

1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.
3. Round stainless steel wall access cover with screw and no-hub cleanout.

2.2 FLOOR DRAINS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company.
2. Smith, Jay R. Mfg. Co.
3. Tyler Pipe; Wade Div.
4. Zurn Plumbing Products Group.

B. Floor Drains, FD-1:

1. Standard: ASME A112.6.3.
2. Body Material: Coated cast iron.
3. Bottom Outlet with Seepage & Anchor Flange with clamping device.
4. Strainer: 6" Round Nickel bronze, Light Duty.

C. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 100 feet.
 - 4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4- inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1- inch total depression.
 - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- H. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
- I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to applicable Division 07 Section.
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

SECTION 22 3300 - ELECTRIC, DOMESTIC WATER HEATERS

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. Commercial, electric, storage, domestic water heaters.
 - 2. Thermostat-control, electric, tank-less, domestic water heaters.
 - 3. Domestic-water heater accessories.

1.3 SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated.
- B. LEED Submittal:
 - 1. Product Data for Prerequisite EA 2: Documentation indicating that units comply with ASHRAE/IESNA 90.1, Section 7, "Service Water Heating."
- C. Shop Drawings:
 - 1. Wiring Diagrams: For power, signal, and control wiring.
- D. Domestic Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- E. Source quality-control reports.
- F. Field quality-control reports.
- G. Operation and maintenance data.
- H. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

- C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Periods: From date of Substantial Completion.
 - a. Commercial, Electric, Storage, Domestic Water Heaters:
 - 1) Storage Tank: Three years.
 - 2) Controls and Other Components: Three years.
 - b. Electric, Tank-less, Domestic Water Heaters: One year.
 - c. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, DOMESTIC WATER HEATERS

- A. Commercial, Electric, Storage, Domestic Water Heaters:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on drawings or comparable product by one of the following:
 - a. A. O. Smith.
 - b. Lochinvar Corporation.
 - c. PVI Industries, LLC.
 - d. State Industries.
 - 2. Standard: UL 1453.
 - 3. Storage-Tank Construction: ASME-code, steel vertical arrangement.
 - a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
 - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.

4. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - c. Insulation: Comply with ASHRAE/IESNA 90.1.
 - d. Jacket: Steel with enameled finish.
 - e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
 - f. Temperature Control: Adjustable thermostat.
 - g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
 - h. Relief Valves: ASME rated and stamped for combination temperature-and- pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
5. Special Requirements: NSF 5 construction.
6. Capacity and Characteristics: As indicated on the drawings.
7. Temperature Setting: 140 deg F.

2.2 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test domestic water heaters to minimum of one and one-half times pressure rating before shipment.
- C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC WATER HEATER INSTALLATION

- A. Commercial, Electric, Domestic Water Heater Mounting: Install commercial, electric, domestic- water heaters on concrete base. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-Place Concrete".
1. Exception: Omit concrete bases for commercial, electric, domestic water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated on the drawings.
 2. Maintain manufacturer's recommended clearances.
 3. Arrange units so controls and devices that require servicing are accessible.
 4. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 5. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 6. Install anchor bolts to elevations required for proper attachment to supported equipment.
 7. Anchor domestic-water heaters to substrate.
- B. Electric, Tank-less, Domestic Water Heater Mounting: Install electric, tank-less, domestic water heaters 18 inches on wall bracket.
1. Maintain manufacturer's recommended clearances.
 2. Arrange units so controls and devices that require servicing are accessible.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 5. Anchor domestic-water heaters to substrate.
- C. Install electric, domestic water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
1. Install shutoff valves on domestic water supply piping to domestic water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Division 22 Section "Domestic Water Piping Specialties."
- F. Install thermometers on outlet piping of electric, domestic water heaters. Comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."

- G. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.
- H. Fill electric, domestic water heaters with water.
- I. Charge domestic water compression tanks with air.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic water heaters.

3.3 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.
- C. Prepare test and inspection reports.

END OF SECTION 22 3300

SECTION 22 4000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Faucets for lavatories and showers.
 - 2. Flushometers for water closets and urinals.
 - 3. Toilet seats.
 - 4. Protective shielding guards.
 - 5. Fixture supports.
 - 6. Water closets.
 - 7. Urinals.
 - 8. Lavatories.
 - 9. Sinks and sink faucets.
 - 10. Service sinks and faucets.
 - 11. Mop sinks and faucets.
- B. Related Sections include the following:
 - 1. Section 22 1118 "Domestic Water Distribution System."
 - 2. Section 22 2114 "Plumbing Specialties."

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. FRP: Fiberglass-reinforced plastic.
- D. PMMA: Polymethyl methacrylate (acrylic) plastic.
- E. PVC: Polyvinyl chloride plastic.
- F. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, and including fixture/item dimensions and rough-in dimensions.
- C. Shop Drawings: Diagram power, signal, and control wiring, and for fixture supports and carriers.
- D. Operation and maintenance data.
- E. At closeout, Northwestern University Maintenance Requirement Forms, see Division 01 for more information.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101- 336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- D. Comply with California Health and Safety Code 116875 (AB 1953) - 2010, for 25% low lead content of piping, pipe fittings, and faucets for water intended for human consumption, and NSF/ANSI Standard 61, including Annex G-2010 - Drinking Water System Components - Low Lead Content Requirement.
- E. Comply with NSF/ANSI 372 - Low Lead Content Verification Requirement
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
 - 2. Stainless-Steel Sinks: ASME A112.19.3.
 - 3. Vitreous-China Fixtures: ASME A112.19.2M.
 - 4. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.

5. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
 2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
 3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
 4. Faucets: ASME A112.18.1.
 5. Hose-Connection Vacuum Breakers: ASSE 1011.
 6. Hose-Coupling Threads: ASME B1.20.7.
 7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 8. NSF Potable-Water Materials: NSF 61.
 9. Pipe Threads: ASME B1.20.1.
 10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 11. Supply Fittings: ASME A112.18.1.
 12. Brass Waste Fittings: ASME A112.18.2.
- I. Comply with the following applicable standards and other requirements specified for shower faucets:
1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
 2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
 3. Faucets: ASME A112.18.1.
 4. Hand-Held Showers: ASSE 1014.
 5. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
 6. Hose-Coupling Threads: ASME B1.20.7.
 7. Manual-Control Antiscald Faucets: ASTM F 444.
 8. Pipe Threads: ASME B1.20.1.
 9. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
 10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 11. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
- J. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
1. Atmospheric Vacuum Breakers: ASSE 1001.
 2. Brass and Copper Supplies: ASME A112.18.1.
 3. Manual-Operation Flushometers: ASSE 1037.
 4. Plastic Tubular Fittings: ASTM F 409.
 5. Brass Waste Fittings: ASME A112.18.2.
 6. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
- K. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Flexible Water Connectors: ASME A112.18.6.
 2. Hose-Coupling Threads: ASME B1.20.7.
 3. Off-Floor Fixture Supports: ASME A112.6.1M.
 4. Pipe Threads: ASME B1.20.1.
 5. Plastic Toilet Seats: ANSI Z124.5-2013.
 6. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 SPECIAL WARRANTIES

- A. Five (5) years, see Division 01 for more information.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. For flushing fixtures, lavatories, showers, service sinks, and mop sinks specified below, subject to compliance with requirements, provide the products indicated in the Fixture Schedule on the drawings, or a comparable product by one of the following:
 - 1. Kohler (preferred).
 - 2. American Standard (acceptable alternate).
- B. For Non-Lab duty faucets, subject to compliance with requirements, provide the products indicated in the Fixture Schedule on the drawings, or a comparable product by one of the following:
 - 1. Kohler.
 - 2. Moen.
 - 3. Sloan Valve.
- C. For water closet and urinal flushometers, subject to compliance with requirements, provide the products indicated in the Fixture Schedule on the drawings, or a comparable product by one of the following:
 - 1. Moen (preferred).
 - 2. Sloan Valve.

2.2 LAVATORY FAUCETS

- A. Lavatory Faucets:
 - 1. Description: Single-control manual mixing valve. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Body Material: Commercial, solid brass.
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: 0.5 gpm.
 - d. Centers: 4 inches.
 - e. Mounting: Deck, exposed.
 - f. Valve Handle: Lever.
 - g. Inlets: NPS 3/8 tubing, with NPS 1/2 male adaptor.
 - h. Spout: Rigid type.
 - i. Spout Outlet: Spray, 0.5 gpm.
 - j. Operation: Non-compression, manual.
 - k. Drain: Grid.

****OR****

B. Lavatory Faucets:

1. Description: ADA compliant, electrically powered, sensor operated faucet. Coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Body Material: Commercial, solid brass.
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: 0.5 gpm.
 - d. Centers: 4 inches.
 - e. Mounting: Deck, exposed.
 - f. Inlet(s): NPS 3/8 tubing, with NPS 1/2 male adaptor.
 - g. Spout: Rigid type.
 - h. Spout Outlet: Laminar flow, 0.5 gpm.
 - i. Operation: sensor actuator, hardwired.
 - j. Drain: Grid.

C. Lavatory Faucets:

1. Description: Single-control manual mixing valve. Include hot and cold water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Body Material: Commercial, solid brass.
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: 0.5 gpm.
 - d. Centers: 8 inches.
 - e. Mounting: Deck, exposed.
 - f. Valve Handle: Lever.
 - g. Inlets: NPS 3/8 tubing, with NPS 1/2 male adaptor.
 - h. Spout: Swing gooseneck, with dimensions to best serve lavatory use in each location.
 - i. Spout Outlet: Laminar flow, 0.5 gpm.
 - j. Operation: Non-compression, manual.
 - k. Drain: Grid.

****OR****

D. Lavatory Faucets:

1. Description: ADA compliant, electrically powered, sensor operated faucet. Coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Body Material: Commercial, solid brass.
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: 0.5 gpm.
 - d. Centers: 8 inches.
 - e. Mounting: Deck, exposed.
 - f. Inlet(s): NPS 3/8 tubing, with NPS 1/2 male adaptor.
 - g. Spout: Swing gooseneck, with dimensions to best serve lavatory use in each location Rigid type.

- h. Spout Outlet: Laminar flow, 0.5 gpm.
- i. Operation: sensor actuator, hardwired.
- j. Drain: Grid.

2.3 FLUSHOMETERS

A. Water Closet Flushometers:

1. Description: Exposed, electrically powered, sensor operated, piston type flushometer for water-closet-type fixture. Include brass body with corrosion-resistant internal components, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
 - a. Internal Design: Piston operation.
 - b. Style: Exposed.
 - c. Inlet Size: NPS 1.
 - d. Trip Mechanism: Battery powered operated sensor actuator.
 - e. Consumption: 1.6 [1.28] gal/flush.
 - f. Tailpiece Size: NPS 1-1/2 and standard length to top of bowl.
 - g. Manual override button.

B. Flushometers:

1. Description: Exposed, electrically powered, sensor operated, piston type flushometer for urinal-type fixture. Include brass body with corrosion-resistant internal components, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
 - a. Internal Design: Piston operation.
 - b. Style: Exposed.
 - c. Inlet Size: NPS 3/4.
 - d. Trip Mechanism: Battery powered operated sensor actuator.
 - e. Consumption: 0.5 [0.125] gal/flush.
 - f. Tailpiece Size: NPS 3/4 and standard length to top of urinal.
 - g. Manual override button.

2.4 TOILET SEATS

A. Toilet Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Bemis Manufacturing Company, Duraguard (Basis of Design).
 - c. Church Seats.
 - d. Olsonite Corp.

2. Description: Toilet seat for water-closet-type fixture, heavy duty commercial.
 - a. Material: Molded, solid plastic with antimicrobial agent.
 - b. Configuration: Open front without cover.
 - c. Size: To fit bowl.
 - d. Hinge Type: Self-sustaining.
 - e. Class: Heavy-duty commercial.
 - f. Color: White.
 - g. Fasteners: 300 series stainless steel.

2.5 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Plumberex Specialty Products Inc.
 - b. TRUEBRO, Inc.
 - c. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.
2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold- water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.6 FIXTURE SUPPORTS

A. Manufacturers for Water Closet Supports: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company
2. Smith, Jay R. Mfg. Co.
3. Tyler Pipe; Wade Div.
4. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Water-Closet Supports:

1. Description: Combination carrier designed for accessible or standard mounting as indicated on drawings, for height of wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space. Carrier must meet the 500 lb. minimum load bearing requirements of ASME A112.19.2-2005/CSA B45.1-05.

C. Urinal Supports:

1. Description: Wall plate.

D. Lavatory Supports:

1. Description: Wall plate.

E. Water Cooler Supports:

1. Wall plates.

2.7 WATER CLOSETS

A. Water Closets:

1. Description: Accessible, wall-mounting, back-outlet, vitreous-china fixture designed for flushometer valve operation.
 - a. Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.
 - b. Surface: Antimicrobial surface which inhibits the growth of stain and odor causing bacteria.
 - c. Height: Standard.
 - d. Design Consumption: 1.6 [1.28] gal/flush.
 - e. Color: White.
 - f. Basis of Design: Kohler K-4325-0 "Kingston" model.
2. Description: Accessible, floor-mounting, bottom outlet, vitreous-china fixture designed for flushometer valve operation.
 - a. Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.
 - b. Surface: Antimicrobial surface which inhibits the growth of stain and odor causing bacteria.
 - c. Height: Standard.
 - d. Design Consumption: 1.6 [1.28] gal/flush.
 - e. Color: White.
 - f. Basis of Design: Kohler K-4302-0 "Highcrest" model
3. Description: Accessible, floor-mounting, tank type, bottom outlet, vitreous-china fixture.
 - a. Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.
 - b. Surface: Antimicrobial surface which inhibits the growth of stain and odor causing bacteria.
 - c. Height: Standard.
 - d. Design Consumption: 1.6 [1.28] gal/flush.
 - e. Color: White.
 - f. Basis of Design: Kohler K-3887-0 "Cimarron" model.

2.8 URINALS

A. Urinals:

1. Description: Accessible, wall-mounting, back-outlet, vitreous-china fixture designed for flushometer valve operation.
 - a. Type: Siphon jet.
 - b. Strainer or Trapway: Integral cast strainer with integral trap.
 - c. Design Consumption: 0.5 gal/flush.
 - d. Color: White.
 - e. Supply Spud Size: ¾ inch.
 - f. Outlet Size: 2 inch.

- g. Height: 24 inch.
- h. Basis of Design: Kohler Dexter K-5016-ET-0.

2.9 LAVATORIES

A. Lavatories:

1. Description: Accessible, wall mounted, vitreous-china fixture.
 - a. Type: Wall mounted with front overflow and backsplash.
 - b.** *Size (nominal): XX [20] by XX [18] inches.*
 - c.** *Faucet Hole Punching: [4 inch centers] [8 inch centers].*
 - d. Color: White.
 - e. Supplies: 3/8 inch chrome-plated copper with stops.
 - f. Drain: Grid
 - g. Drain Piping: 1-1/4 by 1-1/2 inch chrome-plated, cast-brass P-trap; 1-1/2 inch, 0.045-inch- thick tubular brass waste to wall; and wall escutcheon.
 - h. Fixture Support: Required.
 - i. Protective Shielding Guards: Required.
 - j. Basis of Design: Kohler K-2030-0 "Greenwich" for 8" centers, Kohler K-2032-0 "Greenwich" for 4" centers.

B. Lavatories, L-2:

1. Description: Accessible, countertop, vitreous-china fixture.
 - a. Type: Self-rimming countertop type with front overflow.
 - b.** *Size (nominal): XX [20] by xx [18] inches.*
 - c.** *Faucet Hole Punching: [4 inch centers] [8 inch centers].*
 - d. Color: White.
 - e. Supplies: NPS 3/8 chrome-plated copper with stops.
 - f. Drain: Grid.
 - g. Drain Piping: 1-1/4 x 1-1/2 inch chrome-plated, cast-brass P-trap; 1-1/2 inch, 0.045-inch- thick tubular brass waste to wall; and wall escutcheon.
 - h. Protective Shielding Guards: Required.
 - i. Basis of Design: Kohler K-2337-8 "Memoirs" for 8" centers, Kohler K-2337- "Memoirs" for 4" centers.

2.10 SINKS

A. Sinks:

1. Subject to compliance with requirements, provide the product indicated in the Fixture Schedule on the drawings or a comparable product by one of the following:
 - a. Elkay.
 - b. Just Manufacturing Company.
 - c. Moen Commercial
2. Description: One or Two-bowl, as indicated below or as scheduled, counter-mounted, self rimming stainless-steel sink.

- a. *Overall Dimensions: (S-1) 17 x 16 inch single bowl, and/or (S-2) 43 x 22 inch double bowl (S-2).*
- b. *Metal Thickness: 18 gauge Type 304 stainless steel.*
- c. *Bowl Dimensions: (S-1) 14 x 10 x 6½ inches and (S-2) 19 x 16 x 7 5/8 inches.*
- d. *Drain: 3-1/2-inch crumb cup strainers centered in bowls.*
- e. *Sink Faucet: Polished chrome plated body, gooseneck swing spout, lever handles, ADA design, and 1.5 GPM aerator.*
- f. *Faucet Hole Punching: [4 inch centers] [8 inch centers] [other - specify].*
- g. *Supplies: ½ inch chrome-plated copper with stops.*
- h. *Drain Piping: 1½ inch chrome-plated, cast-brass P-trap; 0.045 inch thick tubular brass waste to wall, and wall escutcheon.*

2.11 SERVICE SINKS

A. Service Sinks, SS:

- 1. Description: Trap-standard- and wall-mounting, enameled, cast-iron fixture with roll-rim two faucet holes in back and rim guard on front and sides.
 - a. *Size: 22 by 18 inches.*
 - b. *Color: White.*
 - c. *Faucet: Sink mount utility type with lever handles, bucket hook, stops, vacuum breaker, spout support, and polished chrome finish. Chicago Faucet (preferred), or approved equal. No threads allowed spouts.*
 - d. *Drain: Grid with NPS 3 outlet.*
 - e. *Trap Standard: NPS 3 enameled, cast iron with cleanout and floor flange.*
 - f. *Fixture Support: Wall hanger furnished with sink.*

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 - 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install fixtures level and plumb according to roughing-in drawings.
- G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
- H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- J. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- K. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- L. Install toilet seats on water closets.
- M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- N. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- O. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- P. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- Q. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

- R.** Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in *Division 22 Section "Escutcheons for Plumbing Piping."*
- S.** Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in *Division 07 Section "Joint Sealants."*

3.2 CONNECTIONS

- A.** Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B.** Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C.** Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D.** Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A.** Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B.** Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C.** Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D.** Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E.** Install fresh batteries in sensor-operated mechanisms.

3.4 PROTECTION

- A.** Provide protective covering for installed fixtures and fittings.
- B.** Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4000

SECTION 23 0517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel or Stainless steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, or Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Presealed Systems.

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.

2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
 3. Using sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
1. Cut sleeves to length for mounting flush with both surfaces.
 2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves, Galvanized-steel- pipe sleeves, or Sleeve-seal fittings.

- b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves or Galvanized-steel- pipe sleeves.
2. Exterior Concrete Walls below Grade:
- a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system, galvanized-steel-pipe sleeves with sleeve-seal system, or sleeve-seal fittings.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs-on-Grade:
- a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system, Galvanized-steel-pipe sleeves with sleeve-seal system, or Sleeve-seal fittings.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves with sleeve-seal system, Galvanized-steel-pipe sleeves with sleeve-seal system, or Galvanized- steel-pipe sleeves.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
4. Concrete Slabs above Grade:
- a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves or Sleeve- seal fittings.
 - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves.
5. Interior Partitions:
- a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 23 0517

SECTION 23 0529 - MECHANICAL SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

B. Related Sections:

1. Section 05 5000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 23 0516 "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
3. Section 23 3114 "Ductwork" for duct hangers and supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product used on the project.

1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.
 - 3. Pipe stands.
 - 4. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of trapeze hangers.
 - 2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Hangers and Supports for mechanical and plumbing piping shall be in accordance with MSS Standards.
 - 1. MSS SP-58 – Pipe Hangers and Supports – Materials, Design and Manufacturer
 - 2. MSS SP-69 – Pipe Hangers and Supports – Selection and Application
 - 3. MSS SP-89 – Pipe Hangers and Supports – Fabrication and Installation Practices
- D. Hangers and Supports for fire protection piping shall be in accordance with NFPA Standards. Provide products which are UL listed and FM approved.
 - 1. NFPA 13 – Standard for the Installation of Sprinkler Systems

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components, coated.
2. Galvanized Metallic Coating: Hot dip galvanized.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel with either electroplated zinc or hot dipped galvanized finish.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

C. Stainless Steel Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, stainless steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop or field-fabricated pipe-support assembly made from structural hot-dip galvanized, carbon-steel shapes with MSS SP-58 hot-dip galvanized or electro-coated zinc, carbon-steel hanger rods, nuts, saddles, and U-bolts. If used, they cannot impede serviceability of equipment.
- B. See delegated design requirements in 1.4 above.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.
 - c. Powerstrut.
 - d. Unistrut Corporation; Tyco International, Ltd.
2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with in-turned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Hot dip galvanized or electroplated zinc.

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carpenter & Paterson, Inc.

2. Clement Support Services.
 3. National Pipe Hanger Corporation.
 4. PHS Industries, Inc.
 5. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
 6. Piping Technology & Products, Inc.
 7. Rilco Manufacturing Co., Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 2. Base: Stainless steel.
 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous- thread rods.
 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless- steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural- steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon- steel shapes, with hot dip galvanized coating.

2.8 MISCELLANEOUS MATERIALS AND REQUIREMENTS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and hot dip galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

- a. Hangers are required to be specific to pipe and ductwork independently and not shared.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers. Multiple, stacked trapeze's are not allowed.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick 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.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.
- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Supports and hangers shall not interfere with equipment access.
- I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- J. Install hangers and supports to allow controlled thermal 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.
- K. Install lateral bracing with pipe hangers and supports to prevent swaying.
- L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, strainers, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- O. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

- c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches long and 0.048 inch thick.
 - b. NPS 4 (DN 100): 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches long and 0.075 inch thick.
5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
7. Un-insulated Piping:
 - a. Where insulation is not required, use similar metal hangers such as copper hangers for copper piping, stainless steel for stainless steel piping, etc.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.
5. Re-galvanize if galvanizing affected.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC- PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099100 "Painting".
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use coated carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- E. Use copper pipe hangers and copper attachments for copper piping and tubing. Likewise for stainless steel piping and tubing, use stainless steel hangers.
- F. Use padded hangers for piping that is subject to scratching.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches of insulation.
 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches of insulation.
 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non- insulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non- insulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon- steel plate, and with U-bolt to retain pipe.
 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2- 1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- i. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
- J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1- 1/4 inches (32 mm).
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- P. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 23 0529

SECTION 23 0553 - MECHANICAL SYSTEMS IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Division 23 Section 23 2113 - Hydronic Piping
- C. Division 23 Section 23 2116 - Hydronic Piping Specialties
- D. Division 23 Section 23 2213 - Steam Piping
- E. Division 23 Section 23 2216 - Steam Piping Specialties
- F. Division 23 Section 23 3114 - Ductwork
- G. Division 23 Section 23 3314 - Ductwork Specialties

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Valve tags.
 - 5. Duct labels.
 - 6. Bar coding new equipment and components (see 3.7 at end of this section).

1.3 SUBMITTAL

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURER'S for Labels: Brady, Kolbi, or Panduit.

2.2 EQUIPMENT LABELS

- A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having pre-drilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

1. Label is to also indicate area and type of service being provided.
 - a. For Example AHU - 3 Services floors 1-4 etc.
 - b. P3 HHW Pump Services building perimeter

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.3 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Red.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.4 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, showing flow direction, and area served (i.e. perimeter heating hot water).
- B. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction, and visible all around pipe.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.5 VALVE TAGS

- A. Valve tags shall be per University standards and according to project valve specification section(s). Unless required differently in project valve specification section(s), valve tags to be minimum 1.5" round brass, attached with metallic chains.

2.6 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Red.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.
- J. OTHER SPECIALIZED LABELING AND REQUIREMENTS
 - 1. Fire damper access panels shall be permanently identified on the exterior by labels not less than 2" in height reading "FIRE DAMPER".
 - 2. Smoke damper access panels shall be permanently identified on the exterior by labels not less than 2" in height reading "SMOKE DAMPER".
 - 3. Combination fire/smoke damper access panels shall be permanently identified on the exterior by labels not less than 2" in height reading "RESETTABLE FIRE/SMOKE DAMPER". Mark the other access panels "FIRE/SMOKE DAMPER."
 - 4. Items listed in items 1-3 above, will also be listed on a full size, laminated print and left in the main mechanical room as indicated above.
- K. Duct static pressure sensors shall be permanently identified on the exterior by labels not less than 2" in height reading "STATIC PRESSURE SENSOR".
 - 1. Humidity sensors in ductwork shall be permanently identified on the exterior by labels not less than 2" in height reading "HUMIDITY SENSOR".
 - 2. Abbreviations: No abbreviations to be used.
 - 3. All smoke and fire damper locations are to be posted as a pdf on the DDC system per fan system. This information is also to be located in the fire command center for the building. Coordinate with other trades to make sure this happens, and support as required via that coordination.
 - a. STENCILING
 - 1) Not allowed.
- L. Barcoding New Equipment: Contractor to barcode any new equipment for the University, and in coordination with their requirements.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to and adhere to "Northwestern University Pipe, Valve, and Fittings Standards" for work of this section.

3.2 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 10 feet along each run, and at every change in direction.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color and Marking:
 - 1. Shall be in accordance with ANSI A13.1.

3.5 VALVE TAG INSTALLATION AND DOCUMENTATION

- A. Tag valves according to project valve specification section(s), and provide typed list (loose and framed under glass) per same specification section(s).
 - 1. A valve tag schedule is to be mounted in each mechanical room and on every floor (for that respective floor) in a location to be determined by the Evanston Engineer shop.
 - 2. Each valve tag schedule will have an associated architectural print showing each valve location.
 - 3. At project completion two additional hard copies are to be provided in addition to an electronic copy. One for University Archive and one for the FMO Engineers shop.
 - 4. Two copies of the mechanical piping flow diagram will be supplied. All prints that are supplied that are located in mechanical rooms are to be laminated.
- B. Pipe tags that are the first isolation for a utility in a mechanical room or building need to have indicated where the next upstream valve is located and the associated valve number indicated on the valve tag.

1. This is applicable for all utility isolation valves for each mechanical room space.

3.6 DUCT LABEL INSTALLATION

- A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
 1. Blue: For cold-air supply ducts.
 2. Yellow: For hot-air supply ducts.
 3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. Locate labels at maximum intervals of 10 feet, at every change in direction, and within 3' of wall and floor penetrations on both sides of same.
- C. Along with all other ducting on the job, label toxic exhaust.

3.7 NEW EQUIPMENT BARCODING

- A. Coordinate with University, and bar code all new Division 23 equipment and components for them, according to their requirements. Requirements include, but not limited to, being iPad compatible, have the ability to call up maps of the areas on bar code scans, must have safeguards built in to flag missing items, and the devices on the maps need to be color coded based on inspection status.

END OF SECTION 23 0553

SECTION 23 0594 - TESTING, ADJUSTING, AND BALANCING (TAB)

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes testing, adjusting and balancing HVAC systems to provide design conditions as indicated by the associated drawings. This Section includes, but is not limited to the following:
1. Balancing Air Systems - Constant air volume and variable-air-volume systems.
 2. Balancing Hydronic Piping Systems - Constant and variable-flow hydronic systems, and primary-secondary systems.
 3. Measuring the electrical performance of HVAC equipment.
 4. Verification that automatic control devices are functioning properly.
 5. Measurement of sound levels as related to rotating mechanical equipment.
 6. Vibration testing and analysis of all rotating equipment greater than or equal to 10 hp.
 7. Measurement of duct leakage.
 8. Reporting results of the activities and procedures specified in this Section.
- B. The testing, adjusting and balancing of the air and hydronic systems shall be performed by an independent TAB contractor contracted directly by the University, and approved companies are Arrow Testing and Balancing, CEPro, Hill Mechanical, and ITB (Independent Test and Balance).

1.2 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. Adjust: To regulate fluid flow rates and air patterns at the system or terminal level. At the system level an example would be reducing fan speed; at the terminal level an example would be changing a damper position.
- C. Balance: To proportion air or water flows within the distribution system, including submains, branches and terminals with respect to design quantities.
- D. 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.
- E. Independent: Not affiliated with or in employment of any Contractor.
- F. NEBB: National Environmental Balancing Bureau.
- G. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- H. Report Forms: Test data sheets for recording test data in logical order.

- I. 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.
- J. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- K. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- L. 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.
- M. TAB: Testing, adjusting, and balancing.
- N. TAB Specialist: An entity engaged to perform TAB Work.
- O. Testing, Adjusting and Balancing (TAB) Agent: The entity responsible for performing and reporting the TAB procedures.
- P. Terminal: A point where the controlled medium (fluid or energy) enters or leaves the distribution system.

1.3 PREINSTALLATION MEETINGS

- A. TAB Conference: If requested by the Owner, conduct a TAB conference at project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.
 - 1. Minimum Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Needs for coordination and cooperation of trades and subcontractors.
 - d. Proposed procedures for documentation and communication flow.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within *[30] [60] [90] <Insert number>* days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

- B. Contract Documents Examination Report: Within *[30] [60] [90] <Insert number>* days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within *[30] [60] [90] <Insert number>* days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. System Readiness Checklists: Within *[30] [60] [90] <Insert number>* days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.
- E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- F. Certified TAB reports.
- G. Sample report forms.
- H. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.5 QUALITY ASSURANCE

- A. TAB Specialists Qualifications: Certified by AABC or NEBB.
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC or NEBB.
 - 2. TAB Technician: Employee of the TAB specialist and certified by AABC or NEBB as a TAB technician.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation" but in all cases, all instrumentation used for testing shall be calibrated within 6 months of use, an accuracy of the instrumentation shall not be less than what is specified by the instrument manufacturer.
- C. Certify TAB field data reports and perform the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- E. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.6 FIELD CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 WARRANTY

- A. Provide one of the following performance guarantees:
 - 1. AABC National Project Performance Guarantee
 - 2. NEBB Certificate of Conformance Certification
 - 3. TABB Quality Assurance Program Guarantee
- B. Guarantee shall include provisions that the certified TAB firm has tested and balanced systems according to the Contract Document and that the systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS

2.1 INSTRUMENT TEST HOLES

- A. To be Ventlock #699,

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Ductwork" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

- F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.
 - 5. Balance, smoke, and fire dampers are open.
 - 6. Isolating and balancing valves are open and control valves are operational.
 - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.

8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
 1. Comply with requirements in ASHRAE 62.1-2007, Section 7.2.2, "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test holes and probes to the extent necessary for TAB procedures, and duct test hole fittings shall be provided where shown on the drawings or specified in the Data sheets. T&B instrument test holes to be Ventlock #699.
 1. After testing and balancing, install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "Mechanical System Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust- air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.

- L. Verify that air duct system is sealed as specified in Division 23 Section "Ductwork."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
4. Measure static pressures entering and leaving other devices, such as sound traps, heat- recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan- motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

- A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 1. Manufacturer's name, model number, and serial number.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Phase and hertz.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter size and thermal-protection-element rating.
 8. Service factor and frame size.

- B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.7 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record fan and motor operating data.

3.8 TOLERANCES/ACCEPTED CRITERIA

1. For most spaces, the total supply air quantity to each space of a system shall be within - 5% to +10% of design. Review project specific requirements with NU Project Manager.
2. The percent tolerance of each outlet within a space shall be per Table 23 0594-1.

Table 23 0594-1			
System	Number of Outlets in Space		
	1	2	3 or More
Single Zone, Multizone, VAV	-5% +10%	±10%	± 15%
Heating and Ventilating	-5% +10%	±15%	±15%

3. Air quantity of each return air grille and diffuser shall be within ±10% of design. The design room pressurization must be maintained regardless of the tolerance at each individual diffuser.
4. Vivariums: In general, these laboratories shall be under negative pressure. The design should meet the current NIH Design Requirements Manual for Biomedical Laboratories and Animal Research Facilities. Any reduction in airflow shall be presented by the project Engineer of Record and reviewed by the NU Project Manager and Project Engineer.
5. Culture Rooms: These rooms shall be under positive pressure.
6. Hydronic Systems: Heating and cooling hydronic systems shall be balanced so that the flow is from 0 to +5% of design at each coil.
7. Combination fire/smoke dampers in dynamic smoke control systems shall be tested for closure under airflow conditions (International Mechanical Code – 2009, Section 607), and to assure positive pressure of certain zones, and negative pressure for other zones. Smoke dampers in dynamic smoke control systems must close under airflow conditions.

3.9 REPORTING

- A. All test reports are to have an Executive Summary which shall state extent of system compliance, system deficiencies, and recommended changes.
- B. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- C. Status Reports: Prepare bi-weekly progress 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. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.10 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 - 1. Title page.
 - 2. Name and address of the TAB contractor.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.
 - 9. Signature of TAB supervisor who certifies the report.
 - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 - 12. Nomenclature sheets for each item of equipment.

13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Settings for differential pressure, hydronic differential control
 - i. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

3.11 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB 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 TAB during near-peak summer and winter conditions.

END OF SECTION 23 0594

SECTION 23 0700 - HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
 - a. Flexible elastomeric.
 - b. Mineral fiber.
2. Duct Fire Wrap
3. Insulating cements.
4. Adhesives.
5. Mastics.
6. Sealants.
7. Field-applied jackets.
8. Removable insulation covers.
9. Tapes.
10. Securements.
11. Corner angles.

B. Related Sections:

1. Section 23 3114 "Ductwork."

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.

2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, linkages of control devices, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail field application for each equipment type.

C. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test- response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. Materials and installation in accordance with NFPA 255, UL 723, and MICA (Midwest Insulation Contractors Association).

C. Insulation thickness shall meet the requirements of ASHRAE Standard 90.1 and Northwestern University Standards and shall be selected to eliminate avoid condensation.

1.4 SPECIAL WARRANTIES

A. Five (5) years, see Division 01.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

- F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex (Preferred).
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Atmosphere Duct Wrap.
 - d. Owens Corning; All-Service SOFTR Duct Wrap.
- H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. For equipment applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; CertaPro Commercial Board.
 - b. Johns Manville; 800 Series Spin-Glas.
 - c. Knauf Insulation; Insulation Board.
 - d. Owens Corning; Fiberglas 700 Series.
- I. Mineral-Fiber, Preformed Pipe Insulation:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Micro-Lok.
 - b. Knauf Insulation; Redi-Klad 1000 Pipe Insulation.
 - c. Owens Corning; Fiberglas Pipe Insulation.
 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article. Densities per PART 3 schedules.
- J. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semi-rigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, provide one of the following:

- a. Johns Manville; Fabrication Board.
- b. Knauf Insulation; Pipe and Tank.
- c. Owens Corning; Pipe and Tank.

2.2 Grease Duct Insulation

- A. Products: Subject to compliance with requirements, provide one of the following:
 - 1. 3M Fire Barrier Duct Wrap Type 15A
 - 2. UNIFRAX Fyrewrap
 - 3. Thermal Ceramics Firemaster
- B. Joint free, lightweight, non-asbestos, high temperature, inorganic foil encapsulated ceramic fiber blanket duct wrap for use on commercial grease hood duct systems in accordance with ASTM E2336.
- C. A zero inch clearance to combustible construction and two (2) hour fire resistive rated enclosure system shall be assured.
- D. Adhesives: High performance filament tape, one inch wide, and aluminum foil tape to seal cut edges of blankets.
- E. Banding Material: Two (2) hour requirement, ¾" wide, no less than 0.015 inches thick, Type 304 stainless steel, (stainless steel hose clamps, ½ inch may be substituted for hanger insulations only).
- F. Insulation Pins: 10 gage, 4 inches to 5 inches long, copper coated steel no less than 1-1/2 inch by 1-1/2 inch or 1-1/2 inch diameter galvanized steel speed clip.
- G. Fire Stopping Materials: UL No R9464 classified noncombustible fiber with a flame spread of 0, smoke development of 0 and fuel contribution of 0. Water based, mild chemical resistant putty complying with ASTM E136-82 may be used.

2.3 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Insulco, Division of MFS, Inc.; SmoothKote.
 - b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
 - c. Rock Wool Manufacturing Company; Delta One Shot.

2.4 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Adhesives to be waterproof fire-retardant type.

C. *[Retain subparagraph below if low-emitting materials are required for LEED-NC Credit EQ 4.1.*

1. *For indoor applications, use adhesive for Flexible Elastomeric, ASJ, and PVC Jacket that has a VOC content of 50 g/L or less and for Mineral-Fiber Adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).]*

2.5 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.

2.6 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-76-8.
 - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
 - c. Vimasco Corporation; 750.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacketing and Pre-Formed Fitting Covers: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; roll stock ready jacketing for shop or field cutting and forming, and pre-formed fitting covers. Thicknesses as indicated in field-applied jacket schedules.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston (Preferred), 300 Series if outdoors, 2000 series if indoors.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto PVC Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: White.
 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
 5. Factory-fabricated tank heads and tank side panels.
- D. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; Metal Jacketing Systems.
 - b. PABCO Metals Corporation; Surefit.
 - c. RPR Products, Inc.; Insul-Mate.
 2. Finish and thickness are indicated in field-applied jacket schedules.
 3. Factory-Fabricated Fitting Covers:
 - a. Same material, finish, and thickness as jacket.
 - b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c. Tee covers.
 - d. Flange and union covers.
 - e. End caps.
 - f. Beveled collars.
 - g. Valve covers.
 - h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.9 REMOVABLE INSULATION COVERS

A. Acceptable Manufacturers:

1. Advance Thermal Corp.
2. Thermal Energy Products, Inc.
3. Temptec.
4. Remco Technology, Inc.

B. Removable ceramic blanket type with Velcro tabs and box-stitched, 1.5" wide, D-ring straps, gussets, hot face inner jacketing, type 304 stainless steel tag with laser engraved data riveted to body, outer jacketing, type 304 stainless steel quilting pins, specifically shaped and constructed for insulated item.

2.10 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fason 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Bilrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fason 0827.
 - b. Compac Corp.; 110 and 111.
 - c. Ideal Tape Co., Inc., an American Bilrite Company; 491 AWF FSK.
 - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
 - b. Compac Corp.; 130.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
 - d. Venture Tape; 1506 CW NS.
2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

2.11 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.
- B. Insulation Pins and Hangers:
 1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 2. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive-backed base with a peel-off protective cover.
 3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- C. Wire: 0.062-inch soft-annealed, stainless steel.

2.12 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated (all cold work at a minimum, and it shall be continuous), seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap.
 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Manholes.
 5. Handholes.
 6. Cleanouts.

3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation,

- install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
1. Comply with requirements in Division 07 Section "Penetration Firestopping."
- F. Insulation Installation at Floor Penetrations:
1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 2. Pipe: Install insulation continuously through floor penetrations.
 3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."
- G. Insulation Installation on Pumps:
1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch-diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
 2. Fabricate boxes from aluminum, at least 0.050 inch thick.
 3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless- steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

E. Blanket and Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

- b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not over-compress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section. Install vapor barrier consisting of factory- or field- applied jacket, adhesive, vapor- barrier mastic, and sealant at joints, seams, and protrusions.
- a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor- barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. For Blanket Insulation Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. For Board Insulation, install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
8. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
- 1. Draw jacket material smooth and tight.
 - 2. Install lap or joint strips with same material as jacket.
 - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 - 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.8 FINISHES

- A. Duct, Equipment, and Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 Painting Sections.
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
 2. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
 3. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three Insert number locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor, concealed and exposed supply and outdoor air.
 - 2. Indoor, concealed and exposed return located in non-conditioned non-plenum space.
 - 3. Indoor, exhaust between isolation damper and penetration of building exterior.
 - 4. Outdoor, exposed supply and return.

- B. Items Not Insulated:
 - 1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 - 2. Factory-insulated flexible ducts.
 - 3. Factory-insulated plenums and casings.
 - 4. Flexible connectors.
 - 5. Vibration-control devices.
 - 6. Factory-insulated access panels and doors.

3.11 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
- B. Exposed (in finished spaces), Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1- 1/2 inches thick and 0.75-lb/cu. ft. nominal density.
- C. Concealed, Return-Air Duct and Plenum Insulation: **XXXX**.
- D. Concealed, Outdoor Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
- E. Exposed in Unconditioned Spaces or Mechanical Rooms, Supply-Air, Return-Air, and Outdoor Air Duct and Plenum Insulation: Mineral-fiber board, 1 inches thick and 3-lb/cu. ft. nominal density.
- F. Concealed or Exposed Exhaust and Relief Between Isolation Damper and Penetration of Building Exterior, and Within 20' of the Building Exterior: Mineral-fiber blanket, 2 inches thick and 0.75-lb/cu. ft. nominal density.
- G. Kitchen Hood exhaust ducts shall be insulated with minimum 2-hour rated grease duct wrap.

3.12 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
- B. Exposed, Supply-Air and Return-Air Duct and Plenum Insulation: Mineral-fiber board, 3 inches thick and 6-lb/cu. ft. nominal density.

3.13 EQUIPMENT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
- B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.
- C. Circuit Setters: Insulate with pre-formed insulation sections specifically designed for the specific circuit setters, and adjacent piping insulation and jacketing shall butt to same, and be sealed.
- D. Heat-Exchangers Insulation: Removable insulation covers.
- E. Heating-Hot-Water Pump Insulation: Mineral-Fiber Board/Pipe and Tank: 2 inches thick and 3- lb/cu. ft. nominal density.
- F. Chilled-water air-separator insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Pipe and Tank: 1 inch thick.
- G. Re-heat Coils: VAV and FPVAV reheat coil sections shall have field installed insulation, covering the exposed coil u-bends on both sides of the coil section, coil headers, and the entire reheat section.
- H. See 3.19 through 3.22 below also.

END OF SECTION 23 0700

SECTION 23 2300 – REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.

1.2 SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
 - 1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Comply with ASHRAE 15 (latest edition), "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5 (latest edition), "Refrigeration Piping & Heat Transfer Components."
- C. UL 207 Refrigerant Containing Components and Accessories.

1.4 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.5 INSTALLATION

- A. Provide filter/dryer assemblies, moisture indicators, thermal expansion valve and solenoid valves for each refrigeration circuit.

- B. Pressure test refrigerant piping system at 300 psi for high side and 150 psi for low side. Maintain pressure for a minimum of 24 hours.
- C. Leak test piping and joints with an electronic or halide leak detector.
- D. Evacuate entire system with an approved high vacuum pump system to 500 microns.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Brazing Filler Metals: AWS A5.8.

2.2 VALVES AND SPECIALTIES

- A. To be per Manufacturer's instructions including but not limited to the following:
 - 1. Moisture/Liquid Indicators:
 - 2. Replaceable-Core Filter Dryers: Comply with ARI 730.
 - 3. Permanent Filter Dryers: Comply with ARI 730.
 - 4. Liquid Accumulators: Comply with ARI 495.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Suction Lines, Hot Gas and Liquid Lines All Sizes to be Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.
- B. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, drawn-temper tubing and wrought- copper fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Install all valves and specialties per manufacturer's instructions.

3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Refer to Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls" for solenoid valve controllers, control wiring, and sequence of operation.
- K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- N. Slope refrigerant piping as follows:
 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 2. Install horizontal suction lines with a uniform slope downward to compressor.
 3. Install traps and double risers to entrain oil in vertical runs.
 4. Liquid lines may be installed level.
- O. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation. Insulate suction lines with 1.5" of flexible elastomeric insulation, and weather-proof same outdoors with two coats of insulation manufacturer's weather-proofing coating. Refer to Section 230719 for further general requirements pertaining to pipe insulation.

- Q. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in applicable Division 23 Section. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in applicable Division 23 Section. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in applicable Division 23 Section.

3.4 PIPE JOINT CONSTRUCTION

- A. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

3.5 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

- B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.

- D. Support multi-floor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Piping shall be evacuated, tested, adjusted, and charged in strict accordance with the equipment manufacturer's instructions.

END OF SECTION 23 2300

SECTION 23 2500 - PIPE CLEANING, FLUSHING AND CHEMICAL TREATMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Cleaning of piping systems

1.2 REGULATORY REQUIREMENTS

- A. Conform to applicable EPA code for addition of non-potable chemicals to building mechanical systems and for discharge to public sewage systems.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All materials proposed must be compatible with existing treatment systems and chemicals.
- B. System Cleaner:
 - 1. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products.

2.2 EQUIPMENT

- A. Water Meter: Displacement type cold water meter with sealed, tamper proof magnetic drive, impulse contact register, single pole, double throw dry contact switch.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Systems shall be operational, filled, started and vented prior to cleaning. Use water meter to record capacity in each system.
- B. Place terminal control valves in OPEN position during cleaning.

3.2 CLEANING SEQUENCE

- A. Add cleaner to closed systems at concentration as recommended by manufacturer.

- B. Hot Water Heating Systems: Apply heat while circulating, slowly raising temperature to 160°F and maintain for 12 hours minimum. Remove heat and circulate to 100°F or less; drain systems as quickly as possible and refill with clean water. Circulate for 6 hours at design temperatures, then drain. Refill with clean water and repeat until system cleaner is removed.
- C. Chilled Water Systems: Circulate for 48 hours, then drain systems as quickly as possible. Refill with clean water, circulate for 24 hours, then drain. Refill with clean water and repeat until system cleaner is removed.
- D. Steam Systems: Apply heat, slowly raising boiler temperature to 160°F and maintain for 12 hours minimum. Cool, then drain as quickly as possible. Refill with clean water, drain, refill and check for sludge. Repeat until system is free of sludge. Apply heat to produce steam for piping system and maintain for 8 hours minimum. Bypass traps and waste condensate.
- E. Use neutralizer agents on recommendation of system cleaner supplier and approval of Owner.
- F. Flush open systems with clean water for one hour minimum. Drain completely and refill.
- G. Remove, clean and replace strainer screens.
- H. Inspect, remove sludge and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

END OF SECTION 23 2500

SECTION 23 3114 - DUCTWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Double-wall rectangular ducts and fittings.
3. Single-wall round and flat-oval ducts and fittings.
4. Double-wall round and flat-oval ducts and fittings.
5. Laboratory exhaust ductwork.
6. Sheet metal materials.
7. Duct cleaning and contamination protection.
8. Sealants and gaskets.
9. Hangers and supports.

B. Related Sections:

1. Section 23 0529 "Mechanical Supporting Devices."
2. Section 23 0550 "Vibration Isolation."
3. Section 23 0553 "Mechanical Systems Identification."
4. Section 23 0594 "Testing, Adjusting, and Balancing (TAB)."
5. Section 23 0700 "Mechanical System Insulation."
6. Section 23 3314 "Ductwork Specialties" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, flange connectors, flexible connectors, duct accessory hardware, louvers, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in the "Duct Schedule" Article and on the drawings.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

- D. SMACNA's 3rd Edition, 2005, "HVAC Duct Construction Standards - Metal and Flexible," as referenced herein.

1.4 ACTIONSUBMITTALS/INFORMATION

- A. Product Data: For each type of the following products:

1. Factory fabricated ductwork and fittings.
2. Factory fabricated hangers and supports.
3. Transverse joint components.
4. Sealants and gaskets.

- B. Delegated-Design Information (for Contractor Use and University Reference, Not For Engineer Approval) :

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports.

1.5 INFORMATIONAL SUBMITTALS (For Use Amongst the Contractors and For Owner Reference, Not For Engineer Approval)

- A. Coordination Drawings: 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. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
3. Factory and shop fabricated ducts and fittings.
4. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
5. Elevation of tops or bottoms of ducts.
6. Dimensions of main duct runs from building grid lines.
7. Fittings.
8. Reinforcement and spacing.
9. Seam and joint construction.
10. Penetrations through fire-rated and other partitions.
11. Equipment installation based on equipment being used on Project.
12. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
13. Hangers and supports, including methods for duct and building attachment and vibration isolation.
14. Suspended ceiling components.
15. Structural members to which duct will be attached.
16. Size and location of initial access modules for acoustical tile.
17. Penetrations of smoke barriers and fire-rated construction.
18. Items penetrating finished ceiling including the following:

- a. Lighting fixtures.
- b. Air outlets and inlets.
- c. Speakers.
- d. Sprinklers.
- e. Access panels.
- f. Perimeter moldings.

- B. Welding certificates.
- C. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
 - 3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

1.7 SPECIAL WARRANTIES

- A. Five (5) years, see Division 01.

PART 2 - PRODUCTS

2.1 FIBROUS GLASS (DUCTBOARD) DUCTS

- A. Not allowed.

2.2 LINED DUCTWORK

- A. Not allowed.

2.3 ELBOWS, TRANSITIONS, OFFSETS, BRANCH CONNECTIONS, LATERALS, AND OTHER DUCT CONSTRUCTION REQUIREMENTS

- A. Fabricate and install all duct fittings, branches, inlets, outlets, transitions, take-offs, laterals, offsets, and elbows to minimize air turbulence and resistance and to ensure proper airflows.
- B. Extractors and splitter dampers not allowed.
- C. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's 2005 "HVAC Duct Construction Standards - Metal and

Flexible," Chapters 3 and 4, for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible." But:

1. Mitered elbows with turning vanes not permitted, use radius elbows.
2. Radius elbows shall have minimum centerline radius to width or diameter ratio of 1.5. If 1.5 ratio elbows do not fit, use 1.0 radius elbows. Where 1.0 radius elbows do not fit, use square throat elbows with turning vanes.
3. Pleated or adjustable elbows not allowed.
4. No straight taps, branch or lateral take-offs, or connections, all to be expanded or conical, and taken off at an angle $< 90^\circ$ if possible.
5. No bullhead tees for either diverging or converging flow.
6. For transitions, where the shape of the duct changes, ensure the angle of the side of the transition piece does not exceed 15° from the straight run of duct connected thereto. Where equipment is installed in the ductwork, ensure the angle of the side of the transition piece from the straight run of duct connected thereto does not exceed 15° on the upstream side of the equipment and 22.5° on the downstream side of the equipment.
7. Special duct branch requirements: Where a duct branch handles over 25% of the air transported by the duct main, use a complete 90° increasing elbow, with an inside radius of 0.75 times the duct branch width. Ensure the size of the trailing end of the increasing elbow within the duct main is in the same ratio to the main duct size as the ratio of the relative air quantities being handled. Where a duct branch is to handle 25% or less of the air handled by the duct main, provide a branch connection with an inside radius of 0.75 times the branch duct width, a minimum arc length of 45° , and an outside radius of 1.75 times the duct branch width. Place arc tangent to the duct main.
8. Saddle taps are not allowed on new or existing ducts.
9. See more information and requirements in PART 3 herein.

2.4 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated. But, duct wall thickness to be minimum 22 gage except where any welding other than longitudinal seams is performed, then the minimum thickness shall be 18 gage, and, no crimp joints allowed.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." But, transverse (girth) joints T-4, 9, 17 through 20, and 23 not permitted.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." But, button punch snaplock seams are not permitted.

2.5 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. McGill AirFlow LLC.
 2. SEMCO.
- B. General Fabrication Requirements: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated. Duct wall thickness to be minimum 22 gage except where any welding other than longitudinal seams is performed, then the minimum thickness shall be 18 gage.
- C. Contractor Fabricated Ductwork: Ductwork of this section (2.5) may be fabricated by the contractor if it can be demonstrated that it meets or exceeds the performance of the manufacturer's products listed directly above.
- D. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct. But, duct wall thicknesses to be minimum 22 gage except where any welding other than longitudinal seams is performed, then the minimum thickness shall be 18 gage.
- E. Outer Duct: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- F. Transverse Joints: Select joint types and fabricate according to SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." But, transverse (girth) joints T-4, 9, 17 through 20, and 23 not permitted.
- G. Longitudinal Seams: Select seam types and fabricate according to SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct- support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." But, button punch snaplock seams are not permitted.
- H. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F mean temperature.
 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 3. Coat insulation with antimicrobial coating.
 4. Cover insulation with polyester film complying with UL 181, Class 1.
 5. Insulation Thickness: See PART 3.
- I. Inner Duct: Minimum 0.028-inch thick solid sheet galvanized steel.
- J. Formed-on Transverse Joints (Flanges): Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Traverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible." But, transverse (girth) joints T-4, 9, 17 through 20, and 23 not permitted.

2.6 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated but, only spiral seam or fully welded longitudinal seam duct is to be used. And, longitudinal seam ductwork not to be used if exposed.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. McGill AirFlow LLC.
 - b. SEMCO Incorporated.
 - c. Spiral Manufacturing Co., Inc.
- B. Contractor Fabricated Ductwork: Ductwork of this section (2.6) may be fabricated by the contractor if it can be demonstrated that it meets or exceeds the performance of the manufacturer's products listed directly above.
- C. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension). SMACNA Type 1 reinforcement (Figure 3-6 of SMACNA's Duct Construction Standards) is not allowed.
- D. Transverse Joints: Select joint types and fabricate according to SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible." But, no crimp joints allowed.
1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible." But, snaplock seams not allowed.
1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

2.7 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated but, only spiral seam or fully welded longitudinal seam duct is to be used. And, longitudinal seam ductwork not to be used if exposed.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. McGill AirFlow LLC.
 - b. SEMCO Incorporated.
 - c. Spiral Manufacturing Co., Inc.
 - B. Contractor Fabricated Ductwork: Ductwork of this section (2.7) may be fabricated by the contractor if it can be demonstrated that it meets or exceeds the performance of the manufacturer's products listed directly above.
 - C. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct. SMACNA Type 1 reinforcement (Figure 3-6 of SMACNA's Duct Construction Standards) is not allowed.
 - D. Outer Duct: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
 - E. Transverse Joints: Select joint types and fabricate according to SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible." And, no crimp joints allowed.
 - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
 - F. Longitudinal Seams: Select seam types and fabricate according to SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible." But, no snaplock seams allowed.
 - 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 - 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
 - G. Inner Duct: Minimum 0.028-inch thick solid sheet steel. Factory fabricated, insulated round duct to be McGill Airflow, Acoustic K-27, or approved equal by SEMCO or Spiral Manufacturing Co., Inc.
 - H. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F mean temperature.
 - 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 - 3. Thickness for ducts inside the building minimum 1.5", 3" thickness for ducts outside.
- 2.8 LABORATORY EXHAUST DUCTWORK
- A. Ductwork and shall be all welded Type 316 stainless steel, minimum 18 gage.

2.9 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Duct wall thickness to be minimum 22 gage except where any welding other than longitudinal seams is performed, then the minimum thickness shall be 18 gage.
- B. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- C. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90 (Z275).
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316 (Type 316 only for Lab exhaust), as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- E. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- F. Reinforcement Shapes and Plates for Galvanized Ducts: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black and galvanized-steel shapes and plates are used to reinforce aluminum or stainless steel ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.10 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Water-Based Joint and Seam Sealant:
 - 1. Application Method: Brush on.
 - 2. Solids Content: Minimum 65 percent.
 - 3. Shore A Hardness: Minimum 20.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. VOC: Maximum 75 g/L (less water).
 - 7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
 - 8. Service: Indoor or outdoor.
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive or negative.
11. Service: Indoor or outdoor.
12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint (SMACNA Joints T-24, T-25, and proprietary slip-on flanges) Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Pressure Sensitive Tapes for Primary Sealing of Ducts: Not allowed.

G. Duct Sealer Manufacturers/Products: United Airseal - United Duct Seal, Mon-Eco Industries 44/48, or Foster 32.

H. Lab Exhaust Duct/System Sealant: For any non-welded joints or connections, sealants shall be custom selected for the duty, including proper chemical resistance against whatever is to be transported in the duct system.

2.11 HANGERS AND SUPPORTS

A. Shall be in accordance with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible" except non-engineered wire hangers are not permitted. Engineered cable support systems may be used if they meet SMACNA, Ductmate or approved equal.

B. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

C. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

D. Strap and Rod Sizes: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

- E. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- F. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- G. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- H. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- I. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory or shop fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

- K. Where ducts pass through fire and/or smoke and/or fire/smoke rated surfaces, install appropriate safety dampers. Comply with requirements in Section 23 3314 "Duct Specialties" for safety dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

- A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.
- B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 10 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings.
- C. Install access openings at each change in direction and at intervals defined by NFPA 96; locate on sides of duct a minimum of 1-1/2 inches from bottom; and fit with grease-tight fire rated covers of same material as duct.
- D. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 DUCT SEALING AND CONTAMINATION PROTECTION

- A. Contamination Protection: Ductwork shall be sealed at the point of fabrication/manufacture, and remain sealed until installed. Ductwork must be sealed at all times, even if being worked on. Seals can be removed only during immediate installation and must be restored immediately upon non-work activity. Ductwork being worked on shall be sealed at the end of each work day.
- B. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible."

- C. **Seal all ducts to Seal Class A according to SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible."**

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5- 2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 23 3314 "Duct Specialties."
- B. Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections, and see drawings/details.

3.7 PAINTING

- A. Prime and paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

B. Leakage Tests:

1. Leakage tests shall be conducted in accordance with 1985, 1st Edition, of SMACNA's "HVAC Air Duct Leakage Test Manual," Sections 3 and 5. Positive pressure ductwork to be tested under positive pressure. Negative pressure ductwork to be tested under positive and negative pressure. Submit a test report for each test.
2. Test the following systems:
 - a. Supply Ducts with a Pressure Class of 3-Inch wg (750 Pa) or Higher: Test representative duct sections, selected by Engineer from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - b. All Lab exhaust ductwork.
3. Leakage tests to be witnessed by the University.
4. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
5. Test for leaks before applying external insulation and before ducts are concealed.
6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
7. Give seven days' advance notice for testing.
8. Leakage shall not exceed the values in the following Table 23-3114-3:

Table 23-3114-3 – Allowable Leakage Rates, cfm/100 ft ² Surface Area				
Location	Test Pressure in. wg	Rectangular Ductwork	Round Ductwork	Flat Oval Ductwork
Low Pressure Ductwork ^a	2	9.4	4.7	4.7
All Other Ductwork ^b	4	14.8	7.4	7.4

^a. Supply Ductwork: Ductwork downstream of VAV/CAV Terminals, Return Ductwork: Ductwork upstream of VAV/CAV Terminals.

^b. Supply, Return, and Exhaust Ductwork

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

- E. Prepare test and inspection reports.

3.9 DUCT CLEANING

- A. Clean new duct system(s) before testing, adjusting, and balancing.
- B. Clean existing ducts 10' each direction which become open due to equipment or duct removal, and clean before testing, adjusting, and balancing.
- C. Use service openings for entry and inspection.
 - 1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 23 3314 "Duct Specialties" for access panels and doors.
 - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- D. Particulate Collection and Odor Control:
 - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
 - 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- E. Clean the following components by removing surface contaminants and deposits:
 - 1. Air outlets and inlets (registers, grilles, and diffusers).
 - 2. Supply, return, and exhaust fans including fan housings, plenums, scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 - 3. Air-handling unit internal surfaces and components including mixing box, coil section, condensate drain pans, humidifiers, filters and filter sections, and condensate collectors and drains.
 - 4. Coils and related components.
 - 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
 - 6. Supply-air ducts, dampers, actuators, and turning vanes.
- F. Mechanical Cleaning Methodology:
 - 1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 - 2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 - 3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
 - 4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.

5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.10 START UP

- A. Air Balance: Comply with project TAB requirements.

3.11 DUCT SCHEDULE AND OTHER REQUIREMENTS

- A. Fabricate ducts with galvanized sheet steel unless called for as another material on drawings, or if Lab exhaust, dishwasher exhaust, and any other high humidity applications or areas, ducting to be stainless steel, sloped, and drained.
- B. For outdoor ducts exposed to wind forces, anchor and brace as required.
- C. Flat-oval ducts shall not be used for exhaust.
- D. Fabricate underground ducts with galvanized sheet steel except as otherwise indicated and as follows:
 1. Underground Ducts: Concrete-encased, [galvanized sheet steel] [PVC-coated, galvanized sheet steel with thicker coating on duct exterior] [stainless steel].
 2. **<Insert requirements>**.
- E. Supply Ducts:
 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive **2-inch wg (500 Pa)**.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 2. Ducts Connected to Constant-Volume Air-Handling Units <Insert equipment>:
 - a. Pressure Class: Positive **3-inch wg (750 Pa)** <Insert value>.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
 3. Ducts Connected to Variable-Air-Volume Air-Handling Units <Insert equipment>:
 - a. Pressure Class: Positive **4-inch wg (1000 Pa)** <Insert value>.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 3.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
 4. Ducts Connected to Equipment Not Listed Above:

- a. Pressure Class: Positive **2-inch wg (500 Pa)** <Insert value>.
- b. Minimum SMACNA Seal Class: A.
- c. SMACNA Leakage Class for Rectangular: 6.
- d. SMACNA Leakage Class for Round and Flat Oval: 6.

F. Return Ducts:

- 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units <Insert equipment>:
 - a. Pressure Class: Positive or negative **2-inch wg (500 Pa)**.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
- 2. Ducts Connected to Air-Handling Units <Insert equipment>:
 - a. Pressure Class: Positive or negative **3-inch wg (750 Pa)**.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
- 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative **3-inch wg (750 Pa)**.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.

G. Exhaust Ducts:

- 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative **3-inch wg (750 Pa)**.
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
- 2. Ducts Connected to Air-Handling Units <Insert equipment>:
 - a. Pressure Class: Positive or negative **3-inch wg (750 Pa)**.
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
- 3. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.
 - a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
 - b. Concealed: Carbon-steel sheet.
 - c. Welded seams and joints.
 - d. Pressure Class: Positive or negative **3-inch wg (750 Pa)**.
 - e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
 - f. SMACNA Leakage Class: 3.

4. ***Ducts Connected to Dishwasher Hoods:***
 - a. *Type 304, stainless-steel sheet.*
 - b. *Exposed to View: No. 4 finish.*
 - c. *Concealed: No. 2D finish.*
 - d. *Welded seams and flanged joints with watertight EPDM gaskets.*
 - e. *Pressure Class: Positive or negative 3-inch wg (750 Pa).*
 - f. *Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.*
 - g. *SMACNA Leakage Class: 3.*

 5. ***Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air:***
 - a. *Type 316, stainless-steel sheet.*
 - 1) *Exposed to View: No. 4.*
 - 2) *Concealed: No. 2B finish.*
 - b. *Pressure Class: Positive or negative 4-inch wg (1000 Pa).*
 - c. *Minimum SMACNA Seal Class: A, Welded seams, joints, and penetrations.*
 - d. *SMACNA Leakage Class: 3.*

 6. ***Ducts Connected to Equipment Not Listed Above:***
 - a. *Pressure Class: Positive or negative 3-inch wg (750 Pa).*
 - b. *Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.*
 - c. *SMACNA Leakage Class for Rectangular: 3.*
 - d. *SMACNA Leakage Class for Round and Flat Oval: 3.*
- H. *Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:***
1. ***Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units <Insert equipment>:***
 - a. *Pressure Class: Positive or negative 2-inch wg (500 Pa).*
 - b. *Minimum SMACNA Seal Class: A.*
 - c. *SMACNA Leakage Class for Rectangular: 6.*
 - d. *SMACNA Leakage Class for Round and Flat Oval: 3.*

 2. ***Ducts Connected to Air-Handling Units <Insert equipment>:***
 - a. *Pressure Class: Positive or negative 3-inch wg (750 Pa).*
 - b. *Minimum SMACNA Seal Class: A.*
 - c. *SMACNA Leakage Class for Rectangular: 6.*
 - d. *SMACNA Leakage Class for Round and Flat Oval: 3.*

 3. ***Ducts Connected to Equipment Not Listed Above:***
 - a. *Pressure Class: Positive or negative 3-inch wg (750 Pa).*
 - b. *Minimum SMACNA Seal Class: A.*
 - c. *SMACNA Leakage Class for Rectangular: 6.*
 - d. *SMACNA Leakage Class for Round and Flat Oval: 6.*

I. Intermediate Reinforcement:

- 1. Galvanized-Steel Ducts: Galvanized steel.**
- 2. PVC-Coated Ducts:**
 - a. *Exposed to Airstream: Match duct material.*
 - b. *Not Exposed to Airstream: Match duct material.*
- 3. Stainless-Steel Ducts:**
 - a. *Exposed to Airstream: Match duct material.*
 - b. *Not Exposed to Airstream: Match duct material.*
- 4. Aluminum Ducts: Aluminum.**

J. Double-Wall Duct Interstitial Insulation:

- 1. Supply Air Ducts: 2 inches (51 mm) thick.**
- 2. Return Air Ducts: 2 inches (51 mm) thick.**
- 3. Exhaust Air Ducts: 2 inches (51 mm) thick.**

K. Elbow Configurations To Be Use, Unless More Stringent Requirements Are Required Per PART 2 of This Section:

- 1. Rectangular Duct: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."**
 - a. Velocity 1000 fpm (5 m/s) or Lower:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm (7.6 m/s) or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
- 2. Rectangular Duct: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."**
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.5 radius-to-diameter ratio and two vanes.

- c. Mitered Type RE 2 with vanes complying with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - 3. Round Duct: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm (5 m/s) or Lower: 1.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.5 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 Inches (305 mm) and Smaller in Diameter: Stamped.
 - c. Round Elbows, 14 Inches (356 mm) and Larger in Diameter: Welded.
- L. Branch Configurations To Be Use, Unless More Stringent Requirements Are Required Per PART 2 of This Section:
 - 1. Rectangular Duct: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: 45-degree entry and transition.
 - 2. Round and Flat Oval: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees."
 - a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap, conical.
 - b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
 - c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION 23 3113

SECTION 23 3314 - DUCTWORK SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Fire dampers.
4. Smoke dampers.
5. Combination fire/smoke dampers.
6. Flange connectors.
7. Turning vanes.
8. Duct-mounted access doors and panels.
9. Flexible connectors.
10. Flexible ducts.
11. Duct accessory hardware.
12. Louvers.
13. Duct Sound Attenuators.

1.2 SUBMITTALS

A. Product and Technical Data: For each type of product indicated, including (but not limited to) installation requirements, dimensions, color charts and water penetration data for louvers, wiring diagrams, dynamic insertion loss and self-noise data for attenuators, and air pressure drop information.

B. [LEED Submittals:

1. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1-2007, Section 5 - "Systems and Equipment."
2. Any data that can be used for recycled content and regional materials credits.]

C. Operation and maintenance data.

D. Northwestern University Maintenance Requirement Forms, see Division 01.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating, and with AMCA 500-L for louver performance.

C. For louver finishes, comply with applicable SSPC and AAMA requirements.

- D. For duct sound attenuators, they shall be tested in accordance with ASTM E-477-99 silencer test standard in a certified test facility which is NVLAP accredited for the testing.

1.4 SPECIAL WARRANTIES

- A. Five (5) years, see Division 01.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Exposed-Surface Finish: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 except for Lab exhaust, which shall be Type 316.
- D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6, except for louvers, which are to be Temper T5.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 DAMPERS – BACKDRAFT, VOLUME, FIRE, SMOKE, FIRE/SMOKE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Air Balance.
 - 2. Cesco.
 - 3. Greenheck Fan Corporation.
 - 4. Nailor Industries Inc.
 - 5. Prefco (Basis of Design)
 - 6. Ruskin Company.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Description: Gravity balanced.

- B. Maximum Air Velocity: 3000 fpm.
- C. Maximum System Pressure: 2-inch wg.
- D. Frame: 0.052-inch- thick, galvanized sheet steel, with welded corners.
- E. Blades: Multiple single-piece blades, maximum 6-inch width with sealed edges.
- F. Blade Action: Parallel.
- G. Return Spring: Adjustable tension.
- H. Bearings: Provide end bearings on all dampers. On multiple blade dampers bearing shall be oil-impregnated nylon or sintered bronze.
- I. Accessories:
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. Electric actuators.
 - 4. Chain pulls.
 - 5. Screen Material: Galvanized steel.
 - 6. Screen Type: Bird.
 - 7. 90-degree stops.

2.4 MANUAL VOLUME DAMPERS

- 1. Show dampers on Drawings.
- 2. Damper and blade material to match ductwork material
- 3. Standard leakage rating.
- 4. Suitable for horizontal or vertical applications.
- 5. Frames:
 - a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
- 6. Blades:
 - a. Rectangular dampers shall be single blade type in ducts up to 11" high and shall be opposed blade type in ducts 12" high and above.
 - b. Round dampers shall be single blade type.
 - c. Stiffen damper blades for stability.
- 7. Provide end bearings on all dampers. On multiple blade dampers bearing shall be oil-impregnated nylon or sintered bronze.
- 8. Provide locking indicating quadrant regulators on all dampers. Where rod lengths exceed 30-inches, provide a regulator at both ends.
- 9. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
- 10. Jackshaft:
 - a. Size: 1-inch diameter.

- b. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
- c. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

11. Damper Hardware:

- a. 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.
- b. Include center hole to suit damper operating-rod size.
- c. Include elevated platform for insulated duct mounting.

2.5 FIRE DAMPERS

- A. Fire dampers shall be dynamic, multiple airfoil blade type (not curtain type) with integral wall sleeve, constructed in accordance with UL Standard 555.
- B. Closing rating in ducts up to 8-inch wg static pressure class and minimum 4000-fpm velocity.
- C. Dampers shall be for horizontal or vertical mounting and shall be of sizes shown on the drawings.
- D. Dampers shall have 1-1/2 or 3 hour rating as shown on drawings, replaceable 212 degree F fusible link, and access panels (with UL 181 rated viewports), for installation on both sides of damper.

2.6 SMOKE DAMPERS

- A. General Requirements: Label according to UL 555S by an NRTL.
- B. Smoke Detector: Integral, factory wired for single-point connection.
- C. Frame: Multiple blade type (not curtain type); fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- D. Blades: Airfoil, multiple.
- E. Leakage: Class III, and, all seals to be metal-to-metal.
- F. Rated pressure and velocity to exceed design airflow conditions, and dampers to be rated for 4,000 fpm and 8" pressure minimum.
- G. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone caulking.
- H. Damper Motors: [**Modulating**] [**or**] [**two-position**] action, electric.
- I. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Motors."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in [Division 25 Section "Integrated Automation."] [Division 26 Sections.]
 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
 7. Electrical Connection: 115 V, single phase, 60 Hz.
- J. Dampers shall be supplied/installed with access panels (with UL 181 rated viewports), for installation on both sides of damper.
- K. Accessories:
1. Auxiliary switches for [signaling] [fan control] [or] [position indication].
 2. [Momentary test switch] [Test and reset switches], [damper] [remote] mounted.

2.7 COMBINATION FIRE/SMOKE DAMPERS

- A. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL, multiple blade, not curtain type. Basis of Design Prefco Model 5010.
- B. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 4000-fpm velocity.
- C. Fire Rating: 3 hours.
- D. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel, with welded or mechanically attached corners and mounting flange.
- E. Heat-Responsive Device: Reusable electric "McCabe™" link, with an external manual reset lever (see drawing details). The releasing device shall be 24Vdc in compliance with UL 873. The resettable link shall be 280°F, and UL 33 listed.
- F. Smoke Detector: Furnished by electrical.
- G. Blades: Roll-formed, horizontal, interlocking, minimum 0.034-inch- thick, galvanized sheet steel.
- H. Leakage: Class I
- I. Rated pressure and velocity to exceed design airflow conditions.
- J. Mounting Sleeve: Factory-installed, minimum 0.05-inch- (1.3-mm-) thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone caulking.

- K. Master control panel for use in dynamic smoke-management systems.
- L. Damper Motors: two-position action.
- M. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 0513 "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 25.
 - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
 - 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
 - 6. Non-spring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
 - 7. Electrical Connection: 24 or 115 V as called for by control systems specifications, sequences, or on drawings, and as required, single phase, 60 Hz, and as coordinated with electrical contractor.
- N. Accessories:
 - 1. Auxiliary switches for signaling or position indication.
 - 2. Test and reset switches, remote mounted.
 - 3. Access panels (with UL 181 rated viewports), for installation on both sides of damper.
 - 4. Other as required.

2.8 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Nexus PDQ; Division of Shilco Holdings Inc.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.9 TURNING VANES

- A. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vaness and Vane Runners," and 2-4, "Vane Support in Elbows."
- B. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.10 DUCT-MOUNTED ACCESS DOORS

- A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."
 - 1. Door:
 - a. Double wall, rectangular, and 24" x 24" or as close to 24" x 24" as possible.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - d. Fabricate doors airtight and suitable for duct pressure class.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches

2.11 DUCT ACCESS PANEL ASSEMBLIES

- 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. Ductmate Industries, Inc.
 - 2. Flame Gard, Inc.
 - 3. 3M.
- B. Labeled according to UL 1978 by an NRTL.
- C. Panel and Frame: Minimum thickness 0.0428-inch stainless steel.
- D. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.
- E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.
- F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.12 FLEXIBLE CONNECTORS

- A. Manufacturer: Ventfabrics, Model Ventglas.

- B. Materials: Flame-retardant or non-combustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Material shall be crimped into a metal edging strip and shall be approximately 3 inches wide.
- E. Indoor System, Flexible Connector Fabric: Minimum 0.024 " thick glass fabric double coated with neoprene.
 - 1. Minimum Weight: 30 oz./sq. yd..
 - 2. Tensile Strength: Minimum 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.
- F. Outdoor System, Flexible Connector Fabric: Minimum 0.024" thick glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 30 oz./sq. yd..
 - 2. Minimum Tensile Strength: 500 lbf/inch in the warp and 440 lbf/inch in the filling.
 - 3. Service Temperature: Minus 50 to plus 250 deg F.

2.13 FLEXIBLE DUCTS

- 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. Casco.
 - 2. Flexmaster U.S.A., Inc., Type 6.
 - 3. Thermaflex, Model M-KE.
- B. Non-insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 10 to plus 160 deg F.
- C. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; fire resistive vapor-barrier film.
 - 1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 20 to plus 175 deg F.
 - 4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1-2007.
- D. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; fire resistive vapor-barrier film.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 20 to plus 210 deg F.
 - 4. Insulation R-value: Comply with ASHRAE/IESNA 90.1-2007.
- E. Flexible Duct Securement:

1. Clamps: Stainless-steel band with hex screw to tighten band with a worm-gear action or Nylon strap in sizes 3 through 18 inches, to suit duct size.

2.14 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.15 LOUVERS

- A. Horizontal, Drainable-Blade Louvers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Air Balance Inc.; a division of MESTEK, Inc.
 - b. Airolite Company, LLC (The), Basis of Design, Model K6856.
 - c. Cesco Products; a division of MESTEK, Inc.
 - d. Greenheck Fan Corporation.
 - e. Ruskin Company.
2. Louver Depth, Blade Angle, and Free Area: 6 inch depth, blades at 45° angle, and minimum free area of 49.4%.
3. Frame and Blade Materials of Construction and Nominal Thickness: Not less than 0.081 inch, and constructed of ASTM B221 aluminum extrusions, Alloy 6063-T5.
4. Fabrication: Welded.
5. Frame Type: XXXXXXXXXX
6. Sill Type: Extended.
7. Mullion Type: Exposed.
8. Sleeve: Minimum 16 gage galvanized steel, by contractor.
9. Size and performance data: See schedules/drawings.
10. Finish: 2-coat, oven cured Kynar 500, 2.0 mils dry film coating thickness per AAMA 2605.
11. Louver Performance Ratings:
 - a. Free Area: Not less than 7.9 sq. ft. for 48-inch wide by 48-inch high louver.
 - b. Point of Beginning Water Penetration: Not less than 1065 fpm.
 - c. Air Performance: Not more than 0.072-inch wg static pressure drop at 700-fpm free-area intake velocity.
 - d. Air Performance: Not more than 0.17-inch wg static pressure drop at 1000-fpm free-area exhaust velocity.
12. Wind Loads: Determine loads based on a uniform pressure of ***XX lbf/sq. ft. based upon project structural wind values and other data***, acting inward or outward.
13. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
14. Screens: 1/2" aluminum birdscreen finished same as louver, located ***XXXXX***.
15. Insulated Blank-off Panels: ***XXXXXXXXXXXXXXXX***.

2.16 DUCT SOUND ATTENUATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Aerocoustic.
 2. Aerosonics.
 3. Commercial Acoustics, Metalform Corp.
 4. Industrial Acoustics.
 5. McGill AirFlow LLC.
 6. Pottorff/Dynasonics.
 7. Ruskin Sound..
 8. Semco.
 9. Vibro-Acoustics.
- B. General Requirements:
1. Factory fabricated.
 2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke- developed index not exceeding 50 when tested according to ASTM E 84.
 3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Shape:
1. Rectangular straight with splitters or baffles.
 2. Round straight with center bodies or pods.
 3. Rectangular elbow with splitters or baffles.
 4. Round elbow with center bodies or pods.
 5. Rectangular transitional with splitters or baffles.
- D. Rectangular Silencer Outer Casing: ASTM A 653/A 653M, G90 (Z275) galvanized sheet steel minimum 22 ga.
- E. Round Silencer Outer Casing: ASTM A 653/A 653M, G90 (Z275) galvanized sheet steel.
1. Sheet Metal Thickness for Units up to 24 Inches (600 mm) in Diameter: 0.034 inch (0.85 mm) thick.
 2. Sheet Metal Thickness for Units 26 through 40 Inches (660 through 1000 mm) in Diameter: 0.040 inch (1.02 mm) thick.
 3. Sheet Metal Thickness for Units 42 through 52 Inches (1060 through 1300 mm) in Diameter: 0.05 inch (1.3 mm) thick.
 4. Sheet Metal Thickness for Units 54 through 60 Inches (1370 through 1500 mm) in Diameter: 0.064 inch (1.62 mm) thick.
- F. Inner Casing and Baffles: ASTM A 653/A 653M, [G90 (Z275)] [G60 (Z180)] galvanized sheet metal, 0.034 inch (0.85 mm) thick, and with 1/8-inch- (3-mm-) diameter perforations.
- G. Special Construction:
1. Suitable for outdoor use.
 2. High transmission loss **to achieve STC XX**

- H. Connection Sizes: Match connecting ductwork unless otherwise indicated.
- I. Principal Sound-Absorbing Mechanism:
 - 1. [Select type from 1 and 2]
 - a. Reactive type (No Media) Controlled impedance membranes and broadly tuned resonators without absorptive media.
 - b. Dissipative Film-lined type with fill material for Hospital use.
 - 1) Fill Material: Inert and vermin-proof fibrous material
 - 2) Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.
 - 3) Lining : Mylar film
- J. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.
 - 1. Joints: slip or flanged connections.
 - 2. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
 - 3. Reinforcement: Cross or trapeze angles for rigid suspension.
- K. Accessories:**
 - 1. Factory-installed end caps to prevent contamination during shipping.
- L. Source Quality Control: Test according to ASTM E 477.
 - 1. Testing **to** be witnessed by [**Architect**].
 - 2. Record acoustic ratings, including dynamic insertion loss and generated-noise power levels with an airflow of at least 2000-fpm (10-m/s) face velocity.
 - 3. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg (1500-Pa) static pressure, whichever is greater.
- M. Performance and Characteristics: See schedules.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts, and according to manufacturer's instructions/recommendations..
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. All dampers to be accessible and labeled, and are to have at least 24" around them for servicing, adding up to and including valves, actuators, and other devices that need service or need to be accessed to provide service.
- G. Install test holes at fan inlets and outlets and elsewhere as indicated.
- H. Install fire *[and smoke]* dampers according to UL Listing.
- I. Install combination fire/smoke dampers according to UL Listing.
- J. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils and VAV box reheat coils.
 - 2. Upstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Upstream from manual volume dampers, modulating dampers, backdraft dampers, humidifiers, and equipment.
 - 6. Adjacent to and close enough (and on both sides of) to fire, smoke, and combination fire/smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors; and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 7. Maximum 20-foot spacing.
 - 8. Upstream from turning vanes.
 - 9. Maximum 10-feet from every 90° elbow.
 - 10. Control devices requiring inspection.
 - 11. Up and down stream of airflow measuring stations.
 - 12. Elsewhere as indicated.
- K. Install access doors with swing against duct static pressure.
- L. Access Door Sizes:
 - 1. Hand Access: 24" x 24", or 24" by the duct height/width.
 - 2. Head and Hand Access: 18 by 16 inches.
 - 3. Head and Shoulders Access: 21 by 16 inches.
 - 4. Body Access: 25 by 16 inches.
 - 5. Body plus Ladder Access: 25 by 17 inches.
 - 6. Where fusible links are located, there must be a 24" access panel installed.
- M. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

- N. Install flexible connectors to connect ducts to equipment.
- O. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- P. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- Q. Flexible duct elbows at diffusers are not allowed, elbows at diffusers must be sheet metal, see drawing detail(s).
- R. Connect flexible ducts to metal ducts with draw bands.
- S. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- T. For louvers, use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weather-tight connection. Form closely fitted joints with exposed connections accurately located and secured. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weather-tight louver joints are required. Comply with Section 07 9200 "Joint Sealants" for sealants applied during louver installation.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors/panels and verify that purpose of access doors/panels can be performed.
 - 3. Operate fire, smoke, and combination fire/smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 - 4. Inspect turning vanes for proper and secure installation.

END OF SECTION 23 3314

SECTION 23 3400

UNITARY EXHAUST AND SUPPLY FANS AND VENTILATORS PART 1

GENERAL

1.1 DESCRIPTION

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Refer to specification section 23 0000 - HVAC General, all of which applies to work described in this section as if written in full herein. Special attention should be given to Section 2.02 ELECTRICAL WORK for specifics on motor and drive requirements.
- C. Furnish and install all unitary exhaust and supply fans and ventilators of the size, type, capacity and characteristics as shown on the equipment schedules and herein described.
- D. Base fan-performance ratings on actual project site altitude.
- E. Acceptable manufacturers include only those whose products have been in satisfactory use in similar service for not less than five (5) years.
- F. Electrical Standards: Provide electrical motors and products which have been listed and labeled by Underwriters Laboratories Inc. and comply with NEMA Standards.
- G. Certification, Fan Performance: Fans shall be certified to bear the AMCA label for air and sound performance.

PART 2 PRODUCTS

2.1 CENTRIFUGAL AND AXIAL FANS AND VENTILATORS

- A. All units shall be rigidly constructed of materials suitable for the intended service and shall be installed with all accessories listed on the Drawings.
- B. All roof mounted units shall be installed on factory supplied 14-inch high (minimum) insulated roof curbs of the proper type, size and construction for proper mounting. Curbs shall account for all roof slopes and pitches so that the unit is installed level. Units shall be anchored to curbs by a minimum of two lag screws of adequate size on each side. Curbs shall be constructed of galvanized steel, except when the project is located within 5 miles of a sea coast they shall be of aluminum construction.
- C. Outdoor fans shall be completely weatherproof for outdoor installation and shall contain internal vibration isolation to assure smooth and quiet performance.
- D. Fan wheels and blades shall be constructed of aluminum and shall be statically and dynamically balanced at the factory.

2.2 CEILING-CENTRIFUGAL AND CABINET FANS

- A. Units shall be direct-drive type with back-draft damper, acoustically insulated cabinets and speed controller.

PART 3 EXECUTION

3.1 GENERAL

- A. All units shall be installed in accordance with manufacturer's recommendations and as shown on the Drawings.
- B. Ceiling-centrifugal and cabinet fans shall be supported from structural members and shall not rest on the ceiling, on lights or on structural members.
- C. Units shall be interlocked and controlled as indicated on the Drawings.
- D. Ceiling-mounted units shall be installed with ceiling grilles flush with the ceiling.

- E. Curb-mounted fans shall be secured to the roof curb with lag screws in each hole in the fan curb cap.
- F. Electrical connection to the fan motor shall be made through the roof opening inside the roof curb.
- G. Replace fan and motor pulleys as required to achieve design airflow.

END OF SECTION 23 3400

SECTION 23 3600 - AIR TERMINAL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fan-powered air terminal units/devices.
 - 2. Shut off air terminal units/devices.
 - 3. Dual duct terminal units/devices.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- C. Shop Drawings: For air terminal units. Include plans, elevations, sections, details, and attachments to other work.
- D. Field quality-control reports.
- E. Operation and maintenance data.
- F. Northwestern University Maintenance Requirement Forms, see Division 01.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2007, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

1.4 SPECIAL WARRANTIES

- A. Five (5) years, see Division 01.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following (see schedules for Basis of Design):
1. Nailor
 2. Price
 3. Titus
 4. Tuttle and Bailey

2.2 TERMINAL UNIT WALL CONSTRUCTION FOR CRITICAL AREAS/AIR AND NON-CRITICAL AREAS/AIR

- A. For critical areas/air, all units to be double wall. For high humidity areas/air (which are also considered critical, units to be stainless steel (and this requirement for stainless steel for critical areas/air overrides any conflicting material requirements that may exist below). For non-critical areas/air, units can be double wall or single wall fiber free lined.

2.3 SERIES FAN-POWERED AIR TERMINAL UNITS

- A. Configuration: Volume-damper assembly and fan in series arrangement inside unit casing with control components inside a protective metal shroud for installation above a ceiling and in areas without a ceiling.
- B. Casing: **minimum 22 gauge** steel, single wall or double wall for non-critical areas/air, double wall for critical areas/air.
1. Casing Lining:
 - a. Adhesive attached, 3/4" foil faced fibrous-glass insulation complying with ASTM C 1071, with a reinforced foil facing on the airstream side, and having a maximum flame/smoke index of 25/50, for both insulation and adhesive, when tested according to ASTM E 84.
 - b. Elastomeric Closed Cell Foam Insulation is an acceptable alternate. Insulation must meet 25/50 flame/smoke index, and comply with antimicrobial performance of no observed growth per ASTM G-21
 2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
 3. Air Outlet: S-slip and drive connections.
 4. Access: Removable top and bottom panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
 5. Fan: Forward-curved centrifugal.
 6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.
- C. Volume Damper: Minimum 22 gauge steel with shaft rotating in self-lubricating bearings. Shaft shall be clearly marked on the end to indicate damper position.
1. Mechanical stop to prevent overstroking of damper.

2. The air valve leakage shall not exceed 1% of maximum inlet rated airflow at 3" W.G. inlet pressure.
- D. Velocity Sensors: Single axis sensor shall not be acceptable for duct diameters 6" or larger. Multiple pressure sensing points shall be utilized. The total pressure inputs shall be averaged using a pressure chamber located at the center of the sensor. Sensor shall have an error of plus or minus 5% or better.
- E. Motor:
1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 2. Type: Electronically commutated motor.
 3. Fan-Motor Assembly Isolation: Rubber isolators.
 4. Efficiency: Premium efficient.
 5. Motor Speed: Variable, SCR controlled.
 6. Electrical Characteristics: as scheduled on drawings.
- F. Filters: Terminals shall include a 1" thick disposable MERV 7 polyester filter (spun fiberglass is not acceptable). Filter shall be secured with quick release clips, allowing removal without horizontal sliding.
- H. Control Panel Enclosure: Electrical components mounted in control box with removable cover and mounted on side of unit. Incorporate single-point electrical connection to power source.
1. Control Transformer: Factory mounted for control voltage on electric and electronic control units with terminal strip in control box for field wiring of thermostat and power source.
 2. Wiring Terminations: Fan and controls to terminal strip. Terminal lugs to match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized according to NFPA 70.
 3. Disconnect Switch: Factory-mounted, fuse type.
- I. Direct Digital Controls : Single phase unitary controller and actuator as specified in Division 25.
- J. All boxes shall have a maximum NC (Rad.) as scheduled on drawings. If required provide attenuation to meet the NC level as scheduled.

2.4 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Steel rods and nuts.
- B. Steel Cables: Galvanized steel complying with ASTM A 603.
- C. Steel Cable End Connections: Steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- D. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- E. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.

2.5 SOURCE QUALITY CONTROL AIR TERMINAL UNITS

- A. Factory Tests: Test assembled air terminal units according to ARI 880.
 - 1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, and ARI certification seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.
- C. If boxes have coils, install duct access doors downstream of same per Section 23 3314.
- D. ***Install boxes per the installation details on mech. drawing.***

3.2 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches (100 mm) thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches (100 mm) thick.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 CONNECTIONS

- A. Install piping adjacent to air terminal unit to allow service and maintenance.
- B. Connect ducts to air terminal units according to Division 23 Section "Ductwork."
- C. Make connections to inlets of air terminal units with flexible connectors complying with requirements in Division 23 Section "Ductwork Specialties."

3.4 IDENTIFICATION

- A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Division 23 Section "Mechanical Systems Identification" for equipment labels and warning signs and labels.

3.5 FIELD QUALITY CONTROL

- A. Perform Tests and Inspections:
 - 1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
 - 2. ***Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.***
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Air terminal unit will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.6 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
 - 3. Verify that controls and control enclosure are accessible.
 - 4. Verify that control connections are complete.
 - 5. Verify that nameplate and identification tag are visible.
 - 6. Verify that controls respond to inputs as specified.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 23 3600

SECTION 23 4114 - FILTERS

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. Pleated panel filters.
 - 2. Non-supported bag filters.
 - 3. Front- and rear-access filter frames.
 - 4. Electronic air cleaners.
 - 5. Side-service housings.
 - 6. Filter gages.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.
- C. Shop Drawings: For air filters. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show filter rack assembly, dimensions, materials, and methods of assembly of components.
 - 2. Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.
 - 3. Include diagram for power, signal, and control wiring if applicable.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.
- B. Northwestern University Maintenance Requirement Forms, see Division 01.

1.6 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. Provide three complete set(s) of pre-filters for each pre-filter bank, one set for use during construction, one set for building turnover to University, and one spare set.
 - 2. Provide two complete set(s) of after and final filters for each after and final filter bank, one set for building turnover to University, and one spare set.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. ASHRAE Compliance:
 - 1. Comply with applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality"; Section 5 - "Systems and Equipment"; and Section 7 - "Construction and Startup."
 - 2. Comply with ASHRAE 52.2 for MERV for methods of testing and rating air-filter units.
- B. Comply with NFPA 90A and NFPA 90B.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PLEATED PANEL FILTERS

- A. Description: Factory-fabricated, self-supported, extended-surface, pleated, panel-type, disposable air filters with holding frames, **MERV 7, 4" thick**.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AAF International.
 - b. Camfil Farr.
 - c. Flanders Corporation.
- B. Filter Unit Class: UL 900, Class 1 or Class 2.

- C. Media: Interlaced glass or synthetic fibers coated with nonflammable adhesive.
 - 1. Adhesive: As recommended by air-filter manufacturer and with a VOC content of 80 g/L or less.
 - 2. Media shall be coated with an antimicrobial agent.
 - 3. Separators shall be bonded to the media to maintain pleat configuration.
 - 4. Welded-wire grid shall be on downstream side to maintain pleat.
 - 5. Media shall be bonded to frame to prevent air bypass.
 - 6. Support members on upstream and downstream sides to maintain pleat spacing.
- D. Filter-Media Frame: Cardboard frame with perforated metal retainer sealed or bonded to the media.
- E. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.
- F. See schedule on drawing for performance information.

2.3 NON-SUPPORTED BAG FILTERS

- A. Description: Factory-fabricated, dry, extended-surface, non-supported filters with header frames, **MERV 13 or 14** as required for particular application on the project.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AAF International.
 - b. Camfil Farr.
 - c. Flanders Corporation.
- B. Filter Unit Class: UL 900, Class 1 or Class 2.
- C. Media: [**Glass-fiber**] [**Synthetic**] material constructed so individual pockets are maintained in tapered form under rated-airflow conditions by flexible internal supports.
 - 1. Media shall be coated with an antimicrobial agent.
- D. Filter-Media Frame: [**Galvanized steel**] [**Hard polyurethane foam**].
- E. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.
- F. See schedule on drawing for performance information.

2.4 FRONT AND REAR ACCESS FILTER FRAMES

- A. Framing System: Galvanized-steel (minimum 16 gage) framing members with access for either upstream (front) or downstream (rear) filter servicing, cut to size and pre-punched for assembly into modules. Vertically support filters to prevent deflection of horizontal members without interfering with either filter installation or operation.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. AAF International.
- b. Camfil Farr.
- c. Flanders Corporation.

- B. Pre-filters: Incorporate a separate track with spring clips, removable from front [**or back**].
- C. Access Doors: Hinged, with continuous gaskets on perimeter and positive-locking cam or lever type devices, and arranged so filter cartridges can be loaded from either side and access door.
- D. Sealing: Factory-installed, positive-sealing device for each row of filters, to ensure seal between gasketed filter elements and to prevent bypass of unfiltered air.

2.5 ELECTRONIC AIR CLEANERS

- A. Description: Factory-fabricated electronic air cleaner operating by electrostatic precipitation principles.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dynamic Air Quality Solutions.
 - b. Trion, Inc.
 - c. Flanders Corporation.
- B. Collection Cells: Aluminum, independently supported and nested.
 - 1. Ionizing Section: Alternately spaced grounded struts and charged ionizing wires.
 - 2. Collecting Section: Alternately grounded and charged plates, with insulators located out of airstream.
- C. Power Pack: Self-contained, prewired rectifying unit to convert 24-V ac, single-phase, 60-Hz power to approximately 9,500-V dc; include overload protection, on-off switch, pilot light showing operating status, and access door interlock.
- D. Safety Accessories: Manual-reset safety switches and warning lights for filter plenum access doors, signal lights and safety switching upstream and downstream from unit within duct, and enameled high-voltage warning signs.
- E. Controls: Programmable logic controller in remotely mounted NEMA 250, Type 12 enclosure; with integral time clock and manual override.
 - 1. Contacts for enable-disable control by building automation system.
- F. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.6 SIDE-SERVICE HOUSINGS

- A. Description: Factory-assembled, side-service housings, constructed of [**galvanized steel**] [**aluminum**], with flanges to connect to duct or casing system.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. AAF International.
 - b. Camfil Farr.
 - c. Flanders Corporation.
- B. Pre-filters: Integral tracks to accommodate project depth disposable filters.
 - C. Access Doors: Hinged, with continuous gaskets on perimeter and positive-locking cam or lever type devices, and arranged so filter cartridges can be loaded from either side and access door.
 - D. Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames and to prevent bypass of unfiltered air.

2.7 FILTER GAGES

- A. Diaphragm-type gage with dial and pointer in metal case, vent valves, black figures on white background, and front recalibration adjustment.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dwyer Instruments, Inc.
 - 2. Diameter: 4-1/2 inches (115 mm).
 - 3. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5-Inch wg (125 Pa) or Less: 0- to 0.5-inch wg (0 to 125 Pa).
 - 4. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5- to 1.0- Inch wg (125 to 250 Pa) or Less: 0- to 1.0-inch wg (0 to 250 Pa).
 - 5. Scale Range for Filter Media Having a Recommended Final Resistance of 1.0- to 2.0- Inch wg (250 to 500 Pa) or Less: 0- to 2.0-inch wg (0 to 500 Pa).
 - 6. Scale Range for Filter Media Having a Recommended Final Resistance of 2.0- to 3.0- Inch wg (500 to 750 Pa) or Less: 0- to 3.0-inch wg (0 to 750 Pa).
 - 7. Scale Range for Filter Media Having a Recommended Final Resistance of 3.0- to 4.0- Inch wg (750 to 1000 Pa) or Less: 0- to 4.0-inch wg (0 to 1000 Pa).
- B. Accessories: Static-pressure tips, tubing, gage connections, and mounting bracket.

PART 3 - EXECUTION

1.1 INSTALLATION

- A. Equipment Mounting:
 - 1. ***Install filter assemblies on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in [Section 033000 "Cast-in-Place Concrete. "] [Section 033053 "Miscellaneous Cast-in-Place Concrete. "]***
 - 2. Comply with requirements for vibration isolation devices specified in Section 23 0550 "Vibration Isolation."
- B. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.

- C. Install filters in position to prevent passage of unfiltered air.
- D. Install filter gage for each filter bank.
- E. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.
- F. Install filter-gage, static-pressure taps upstream and downstream from filters. Install filter gages on filter banks with separate static-pressure taps upstream and downstream from filters. Mount filter gages on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gages.
- G. Coordinate filter installations with duct and air-handling-unit installations.

1.2 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections:
 - 1. Test for leakage of unfiltered air while system is operating.
- D. Air filter will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

1.3 CLEANING

- A. After completing system installation and testing, adjusting, and balancing of air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION 23 4114

SECTION 23 8128
SPLIT SYSTEM HEAT PUMPS

PART 1 GENERAL

1.1 DESCRIPTION

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 23 0000 - HVAC General.
- C. Furnish and install a direct expansion air-to-air heat pump unit of the size and capacity shown on the equipment schedule. The unit shall be completely factory assembled and tested, and shall include compressor, indoor and outdoor coils, stand-by electric strip heating coils, fan motors as required, pre-wired controls, interconnecting refrigerant tubing, wiring, and circuit breakers. Condensing unit shall be factory matched with evaporator coils and air handling unit; units shall be rated in accordance with AHRI and UL Listed.
- D. Equipment schedules and specifications are intended to establish a minimum level of quality and workmanship for the project. When other than the basis of design equipment is proposed, the Contractor shall be responsible for all costs associated with engineering and construction modifications necessary in his or any other trade that may be required to satisfy the Contract Documents.
- E. Refer to the drawings for basis of design manufacturer and acceptable alternates.

PART 2 PRODUCTS

2.1 GENERAL

- A. Each unit shall be complete and factory packaged consisting of compressor, condenser coil, stand-by electric heating coil, condenser fans and motors, refrigeration and temperature controls, Unit shall be ARI and UL Listed.

2.2 AIR HANDLER

- A. The cabinet shall be complete and constructed of minimum 20-gauge galvanized steel zinc coated and shall be painted with a baked-on powder coating finish. Interior surface of the cabinet shall be lined with a flexible acoustical and thermal insulation and shall be fire proof. Thickness of insulation shall be 1-1/2". Access to fan motor, filters, coils, controls and power supply shall be through the front panel of the unit.
- B. The nonferrous direct expansion cooling coil shall be factory mounted and charged with refrigerant. Provide reversing valve, expansion valve, solenoid valve and complete refrigeration circuit. Provide insulated drain pan with exterior primary and secondary drain connection.
- C. The air handling unit shall accept a 1" thick high velocity air filter, mounted internally and located upstream of the cooling coil.
- D. The blower section shall have an adjustable V-belt or direct drive fan motor with a forward-curved centrifugal type blower mounted on vibration isolators. The fan motor shall have thermal overloads and be permanently lubricated. Direct drive fan motors shall have at least three (3) speeds.
- E. An electric resistance heater shall supplement the heat pump operation.
- F. The unit shall be supplied with a single point power connection.

2.3 OUTDOOR UNIT

- A. The cabinet shall be constructed of galvanized steel with a baked-on enamel finish. Provide with removable access panel at one side of unit to access the compressor, coil, controls, and power supply. Drain holes shall be provided at the base of the unit. Provide fan and coil guards.
- B. The compressor shall be the hermetic scroll or reciprocating type, furnished with complete refrigeration circuit(s) including nonferrous condenser coil, receiver, charging valve, refrigerant holding charge, external service valves, compressor anti-cycle protection, internal temperature and current-sensing overloads, crankcase heater, filter drier, evaporator freeze stat, liquid line solenoid valve, and vibration isolation. Controls shall include over and under voltage protection, high pressure cutout with auto-reset, motor starters and contactors. Compressor shall have a five year warranty.
- C. The fan motor shall be permanently lubricated with built-in thermal overload protection.
- D. Install unit level as indicated on the Drawings.
- E. The unit shall be supplied with a single point power connection.

2.4 CONTROLS

- A. Unless noted otherwise, provide a seven-day programmable thermostat with manual changeover.
- B. The thermostat shall prevent the auxiliary electric heat from being energized whenever the heating load can be met by the heat pump.

PART 3 EXECUTION

3.1 GENERAL

- A. Units shall be installed as shown on the Drawings and in strict accordance with manufacturer's recommendations.
- B. Units shall be installed level.
- C. Units shall be installed to allow adequate service to all components.

END OF SECTION

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.

1.02 RELATED REQUIREMENTS

- A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- C. Section 265600 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA GR 1 - Ground Rod Electrodes and Ground Rod Electrode Couplings 2017.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify exact locations of underground metal water service pipe entrances to building.
 - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittals procedures.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
 - 1. Provide products listed, classified, and labeled as suitable for the purpose intended.

2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions:
 - 1) Use bare copper conductors where installed underground in direct contact with earth.
 - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
- C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
 3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
 - a. Exceptions:
 - 1) Use exothermic welded connections for connections to metal building frame.
 4. Manufacturers - Mechanical and Compression Connectors:
 - a. Advanced Lightning Technology (ALT); [_____]: www.altfab.com/#sle.
 - b. Burndy LLC; [_____]: www.burndy.com/#sle.
 - c. Harger Lightning & Grounding; [_____]: www.harger.com/#sle.
 - d. Thomas & Betts Corporation; [_____]: www.tnb.com/#sle.
 - e. Substitutions: See Section 016000 - Product Requirements.
 5. Manufacturers - Exothermic Welded Connections:
 - a. Burndy LLC; [_____]: www.burndy.com/#sle.
 - b. Cadweld, a brand of Erico International Corporation; [_____] : www.erico.com/#sle.
 - c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; [_____] : www.thermoweld.com/#sle.
 - d. Substitutions: See Section 016000 - Product Requirements.
- D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
 2. Size: As indicated.
 3. Holes for Connections: As indicated or as required for connections to be made.
 4. Manufacturers:
 - a. Advanced Lightning Technology (ALT); [_____]: www.altfab.com/#sle.
 - b. Erico International Corporation; [_____]: www.erico.com/#sle.
 - c. Harger Lightning & Grounding; [_____]: www.harger.com/#sle.
 - d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; [_____] : www.thermoweld.com/#sle.
 - e. Substitutions: See Section 016000 - Product Requirements.
- E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
 2. Material: Copper-bonded (copper-clad) steel.
 3. Size: 3/4 inch (19 mm) diameter by 10 feet (3.0 m) length, unless otherwise indicated.
 4. Manufacturers:
 - a. Advanced Lightning Technology (ALT); [_____]: www.altfab.com/#sle.
 - b. Erico International Corporation; [_____]: www.erico.com/#sle.
 - c. Galvan Industries, Inc; [_____]: www.galvanelectrical.com/#sle.
 - d. Harger Lightning & Grounding; [_____]: www.harger.com/#sle.
 - e. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
- D. Make grounding and bonding connections using specified connectors.
 - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- E. Identify grounding and bonding system components in accordance with Section 260553.

END OF SECTION

SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.
- D. MFMA-4 - Metal Framing Standards Publication 2004.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
 - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of [_____]. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 - 5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
 - 1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 - 2. Conduit Clamps: Bolted type unless otherwise indicated.
- C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
- D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 - 1. Comply with MFMA-4.
- E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
- F. Anchors and Fasteners:
 - 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

END OF SECTION

SECTION 260533.13 CONDUIT
FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Intermediate metal conduit (IMC).
- C. Flexible metal conduit (FMC).
- D. Liquidtight flexible metal conduit (LFMC).
- E. Electrical metallic tubing (EMT).
- F. Electrical nonmetallic tubing (ENT).
- G. Liquidtight flexible nonmetallic conduit (LFNC).
- H. Conduit fittings.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Metal clad cable (Type MC), armored cable (Type AC), and manufactured wiring systems, including uses permitted.
- C. Section 260526 - Grounding and Bonding for Electrical Systems.
 - 1. Includes additional requirements for fittings for grounding and bonding.
- D. Section 260529 - Hangers and Supports for Electrical Systems.
- E. Section 260533.16 - Boxes for Electrical Systems.
- F. Section 260533.23 - Surface Raceways for Electrical Systems.
- G. Section 260539 - Underfloor Raceways for Electrical Systems.
- H. Section 260548 - Vibration and Seismic Controls for Electrical Systems.
- I. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- J. Section 262100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.
- K. Section 312316 - Excavation.
- L. Section 312316.13 - Trenching: Excavating, bedding, and backfilling.
- M. Section 312323 - Fill: Bedding and backfilling.
- N. Section 337119 - Electrical Underground Ducts, Ductbanks, and Manholes.

1.03 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2020.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2020.
- C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit 2018.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2013.
- F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.
- G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- H. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2021.
- I. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT) 2014 (Reaffirmed 2019).

- J. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.
- L. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.
- M. UL 360 - Liquid-Tight Flexible Metal Conduit Current Edition, Including All Revisions.
- N. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.
- O. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.
- P. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.
- Q. UL 1242 - Electrical Intermediate Metal Conduit-Steel Current Edition, Including All Revisions.
- R. UL 1653 - Electrical Nonmetallic Tubing Current Edition, Including All Revisions.
- S. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittals procedures.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

2.02 CONDUIT REQUIREMENTS

- A. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 - 2. Nucor Tubular Products: www.nucortubular.com/#sle.
 - 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
 - 4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
 - 5. Substitutions: See Section 016000 - Product Requirements.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:
 - 1. Manufacturers:
 - a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
 - d. Substitutions: See Section 016000 - Product Requirements.
 - 2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Material: Use steel or malleable iron.

4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

- A. Manufacturers:
 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 2. Nucor Tubular Products: www.nucortubular.com/#sle.
 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
 4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
 5. Substitutions: See Section 016000 - Product Requirements.
- B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- C. Fittings:
 1. Manufacturers:
 - a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
 - d. Substitutions: See Section 016000 - Product Requirements.
 2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.
 4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.05 FLEXIBLE METAL CONDUIT (FMC)

- A. Manufacturers:
 1. AFC Cable Systems, Inc; [_____]: www.afcweb.com/#sle.
 2. Electri-Flex Company; [_____]: www.electriflex.com/#sle.
 3. International Metal Hose; [_____]: www.metalhose.com/#sle.
 4. Substitutions: See Section 016000 - Product Requirements.
- B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
- C. Fittings:
 1. Manufacturers:
 - a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
 - d. Substitutions: See Section 016000 - Product Requirements.
 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Manufacturers:
 1. AFC Cable Systems, Inc; [_____]: www.afcweb.com/#sle.
 2. Electri-Flex Company; [_____]: www.electriflex.com/#sle.
 3. International Metal Hose; [_____]: www.metalhose.com/#sle.
- B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- C. Fittings:
 1. Manufacturers:
 - a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.

- d. Substitutions: See Section 016000 - Product Requirements.
- 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
- 3. Material: Use steel or malleable iron.

2.07 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 - 2. Nucor Tubular Products: www.nucortubular/#sle.
 - 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
 - 4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
 - 5. Substitutions: See Section 016000 - Product Requirements.
- B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- C. Fittings:
 - 1. Manufacturers:
 - a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
 - d. Substitutions: See Section 016000 - Product Requirements.
 - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Material: Use steel or malleable iron.
 - 4. Connectors and Couplings: Use compression (gland) or set-screw type.
 - a. Do not use indenter type connectors and couplings.

2.08 ELECTRICAL NONMETALLIC TUBING (ENT)

- A. Description: NFPA 70, Type ENT electrical nonmetallic tubing complying with NEMA TC 13 and listed and labeled as complying with UL 1653.
- B. Fittings:
 - 1. Manufacturer: Same as manufacturer of ENT to be connected.
 - 2. Use solvent-welded type fittings.
 - 3. Solvent-Welded Fittings: Rigid PVC fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; suitable for use with ENT.

2.09 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

- A. Manufacturers:
 - 1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
 - 2. Electri-Flex Company: www.electriflex.com/#sle.
 - 3. International Metal Hose: www.metalhose.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.
- C. Fittings:
 - 1. Manufacturer: Same as manufacturer of conduit to be connected.
 - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for the type of conduit to be connected.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

- D. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- E. Install electrical nonmetallic tubing (ENT) in accordance with NECA 111.
- F. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.
- G. Conduit Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
- H. Conduit Support:
 - 1. Secure and support conduits in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
 - 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- I. Connections and Terminations:
 - 1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
 - 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
 - 3. Use suitable adapters where required to transition from one type of conduit to another.
 - 4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
 - 5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
 - 6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
 - 7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
- J. Penetrations:
 - 1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
 - 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
 - 3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
 - 4. Conceal bends for conduit risers emerging above ground.
 - 5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
 - 6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
 - 7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
 - 8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- K. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
 - 1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 - 2. Where conduits are subject to earth movement by settlement or frost.
- L. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
 - 1. Where conduits pass from outdoors into conditioned interior spaces.
 - 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

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M. Provide grounding and bonding in accordance with Section 260526.

3.02 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.03 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 260533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete.
- B. Section 078400 - Firestopping.
- C. Section 083100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
- D. Section 260526 - Grounding and Bonding for Electrical Systems.
- E. Section 260529 - Hangers and Supports for Electrical Systems.
- F. Section 260533.13 - Conduit for Electrical Systems:
 - 1. Conduit bodies and other fittings.
 - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- G. Section 260539 - Underfloor Raceways for Electrical Systems: Junction boxes for underfloor duct systems.
- H. Section 260548 - Vibration and Seismic Controls for Electrical Systems.
- I. Section 262726 - Wiring Devices:
 - 1. Wall plates.
 - 2. Floor box service fittings.
 - 3. Poke-through assemblies.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
- C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports 2013 (Reaffirmed 2020).
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- I. UL 508A - Industrial Control Panels Current Edition, Including All Revisions.
- J. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground

boxes/enclosures.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use suitable concrete type boxes where flush-mounted in concrete.
4. Use suitable masonry type boxes where flush-mounted in masonry walls.
5. Use raised covers suitable for the type of wall construction and device configuration where required.
6. Use shallow boxes where required by the type of wall construction.
7. Do not use "through-wall" boxes designed for access from both sides of wall.
8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
12. Wall Plates: Comply with Section 262726.
13. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation; [_____]
: www.cooperindustries.com/#sle.
 - b. Hubbell Incorporated; Bell Products; [_____]: www.hubbell-rtb.com/#sle.
 - c. Hubbell Incorporated; RACO Products; [_____]: www.hubbell-rtb.com/#sle.
 - d. O-Z/Gedney, a brand of Emerson Electric Co; [_____]
: www.emerson.com/#sle.
 - e. Thomas & Betts Corporation; [_____]: www.tnb.com/#sle.
 - f. Or Equal.
 - g. Substitutions: See Section 016000 - Product Requirements.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):

1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

4. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation; [_____]
: www.cooperindustries.com/#sle.
 - b. Hoffman, a brand of Pentair Technical Products; [_____]
: www.hoffmanonline.com/#sle.
 - c. Hubbell Incorporated; Wiegmann Products; [_____]: www.hubbell-wiegmann.com/#sle.
 - d. Or Equal.
 - e. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Box Locations:
 1. Locate boxes to be accessible. Provide access panels in accordance with Section 083100 as required where approved by the Architect.
 2. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
 3. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches (150 mm) horizontal separation unless otherwise indicated.
 4. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) horizontal separation.
 5. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
 - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
- E. Box Supports:
 1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
 2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
- F. Install boxes plumb and level.
- G. Flush-Mounted Boxes:
 1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.
- H. Install boxes as required to preserve insulation integrity.
- I. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

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- J. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- K. Close unused box openings.
- L. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- M. Provide grounding and bonding in accordance with Section 260526.

3.02 CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.03 PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 260533.23
SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface raceway systems.
- B. Wireways.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
 - 1. Includes metal channel (strut) used as raceway.
- C. Section 260533.13 - Conduit for Electrical Systems.
- D. Section 260533.16 - Boxes for Electrical Systems.
- E. Section 260539 - Underfloor Raceways for Electrical Systems: Trench duct.
- F. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 262726 - Wiring Devices: Receptacles.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- D. NEMA PRP 5 - Installation Guidelines for Surface Nonmetallic Raceway 2021.
- E. UL 5 - Surface Metal Raceways and Fittings Current Edition, Including All Revisions.
- F. UL 5A - Nonmetallic Surface Raceways and Fittings Current Edition, Including All Revisions.
- G. UL 870 - Wireways, Auxiliary Gutters, and Associated Fittings Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of raceways with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate rough-in locations of outlet boxes provided under Section 260533.16 and conduit provided under Section 260533.13 as required for installation of raceways provided under this section.
 - 3. Verify minimum sizes of raceways with the actual conductors and components to be installed.
 - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install raceways until final surface finishes and painting are complete.
 - 2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.
 - 1. Surface Raceway Systems: Include information on fill capacities for conductors and cables.

- C. Shop Drawings:
 - 1. Pre-wired Surface Raceway Systems: Provide plan and elevation views including dimensioned locations of wiring devices and circuiting arrangements.
 - 2. Wireways: Provide dimensioned plan and elevation views including adjacent equipment with all required clearances indicated.
- D. Samples: Three of each type and color of surface raceway system specified, 6 inches (150 mm) in length.
- E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 RACEWAY REQUIREMENTS

- A. Provide all components, fittings, supports, and accessories required for a complete raceway system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

2.02 SURFACE RACEWAY SYSTEMS

- A. Manufacturers:
 - 1. Hubbell Incorporated; Or Equal: www.hubbell.com/#sle.
 - 2. MonoSystems, Inc; Or Equal: www.monosystems.com/#sle.
 - 3. Wiremold, a brand of Legrand North America, Inc; Or Equal: www.legrand.us/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Surface Metal Raceways: Listed and labeled as complying with UL 5.
- C. Surface Nonmetallic Raceways: Listed and labeled as complying with UL 5A.

2.03 WIREWAYS

- A. Manufacturers:
 - 1. Cooper B-Line, a division of Cooper Industries; Or Equal: www.cooperindustries.com/#sle.
 - 2. Enduro Composites; Or Equal: www.endurocomposites.com/#sle.
 - 3. Hoffman, a brand of Pentair Technical Products; Or Equal: www.hoffmanonline.com/#sle.
 - 4. Schneider Electric; Square D Products; Or Equal: www.schneider-electric.us/#sle.
 - 5. Substitutions: See Section 016000 - Product Requirements.
- B. Description: Lay-in wireways and wiring troughs with removable covers; listed and labeled as complying with UL 870.
- C. Wireway Type, Unless Otherwise Indicated:
 - 1. Indoor Clean, Dry Locations: NEMA 250, Type 1, painted steel with screw-cover.
 - 2. Outdoor Locations: NEMA 250, Type 3R, painted steel with screw-cover; include provision for padlocking.
- D. Finish for Painted Steel Wireways: (See Comment) unless otherwise indicated.
- E. Where wireway size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.04 SOURCE QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes and conduit terminations are installed in proper locations and are properly sized in accordance with NFPA 70 to accommodate raceways.
- C. Verify that mounting surfaces are ready to receive raceways and that final surface finishes are complete, including painting.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install raceways plumb and level.
- D. Arrange wireways and associated raceway connections to comply with NFPA 70, including but not limited to requirements for deflected conductors and wireways used as pullboxes. Increase size of wireway where necessary.
- E. Secure and support raceways in accordance with Section 260529 at intervals complying with NFPA 70 and manufacturer's requirements.
- F. Close unused raceway openings.
- G. Provide grounding and bonding in accordance with Section 260526.

3.03 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.04 PROTECTION

- A. Protect installed raceways from subsequent construction operations.

END OF SECTION

SECTION 260539
UNDERFLOOR RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Underfloor duct.
- B. Trench duct.
- C. Service fittings.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 262726 - Wiring Devices.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 884 - Underfloor Raceways and Fittings Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work with other trades for the proper placement of concrete provided under other sections.
 - 1. Verify that no concrete containing chlorides from any source will be used in contact with duct system.
 - 2. Where approved by the Architect, arrange for vibration of concrete at duct system to ensure complete fill beneath components.
 - 3. Arrange for hand finishing of concrete adjacent to flush components.
- B. Where cellular floor deck electrical raceway system is provided under other sections, coordinate the work to provide compatible electrical service fittings.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, materials, fabrication details, finishes, conductor and cable fill capacities, service condition requirements, and accessories.
- C. Samples:
 - 1. Trench Duct: One section including cover with trim to be installed.
 - 2. Junction Boxes: One of each type including cover with trim to be installed.
 - 3. Service Fittings: One of each type and finish specified.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 DUCT SYSTEM REQUIREMENTS

- A. Provide all components, fittings, supports, and accessories required for a complete duct system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Do not use duct systems for applications other than as permitted by NFPA 70 and product listing.

2.02 UNDERFLOOR DUCT

- A. Manufacturers:
 - 1. Dennis Filges Company, Inc; Or Equal: www.filgesco.com/#sle.
 - 2. Hubbell Incorporated; Or Equal: www.hubbell.com/#sle.
 - 3. Wiremold, a brand of Legrand North America, Inc; Or Equal: www.legrand.us/#sle.
 - 4. Or Equal.
- B. Configuration: Distribution and header underfloor duct for single service or multiple services as indicated on drawings; for multiple services use multiple compartment duct or parallel single compartment ducts positioned together.
- C. Underfloor Duct:
 - 1. Description: Steel duct with corrosion-resistant coating, designed for installation beneath concrete floor surface; suitable for use as underfloor raceway and listed and labeled as complying with UL 884.
 - 2. Compartment Size:
 - a. Distribution Duct: As indicated on the drawings.
 - b. Header Duct: Same as specified for distribution duct unless otherwise indicated.
 - 3. Preset Inserts:
 - a. Distribution Duct:
 - 1) Type: As required to accommodate specified service fittings.
 - 2) Height: Selected according to depth of concrete cover.
 - 3) Spacing: 24 inches (610 mm).
 - 4) Furnish with removable cap recessed to hold concrete.
 - b. Header Duct: None (blank duct).
- D. Junction Boxes: Standard duty unless otherwise indicated.
 - 1. Provide junction box(es) for connections and intersections of duct runs as indicated or as required for duct configuration installed.
 - 2. Junction Boxes: Furnished with openings on four sides for duct connections and openings on four corners for conduit connections; with partitions to separate multiple services; with integral means for leveling adjustment prior to concrete pour.
 - 3. Height: Selected according to duct to be installed and depth of concrete cover.
 - 4. Cover Plate: Furnished with trim suitable for flooring to be installed.
- E. Duct Supports: Steel with corrosion-resistant coating, with integral means for leveling adjustment prior to concrete pour; height to be selected according to duct to be installed and depth of concrete cover.
- F. Marker Caps: Preset insert caps with integral marker screw for indicating location of duct run after concrete pour; provide different material screws for distinguishing between power and communications duct runs.

2.03 SERVICE FITTINGS

- A. Manufacturer: Same as manufacturer of duct system to be installed.
- B. Description: Service fittings compatible with duct system to be installed with all components, adapters, and trims required for complete installation.
- C. Receptacles: Comply with Section 262726.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Unless otherwise indicated, arrange duct to be parallel or perpendicular to building lines.
- D. Install duct supports located according to manufacturer's recommendations, but not exceeding 5 feet (1.5 m) between supports. Permanently fasten duct supports to the supporting framework.
- E. Provide expansion fittings with suitable bonding jumper where duct crosses structural joints intended for expansion.
- F. Make adjustments such that duct is level at the proper elevation. Unless otherwise indicated, adjust as follows:
 - 1. Underfloor Duct: Tops of inserts 1/8 to 3/8 inch (3.2 to 9.5 mm) below screed line or as required by manufacturer.
- G. Install marker caps in each insert adjacent to junction boxes, at end of each duct run, on both sides of permanent partitions, and on both sides of change in direction of duct. Adjust markers to be flush with finished floor except only extend through backing material for carpeted areas.
- H. Provide grounding and bonding in accordance with Section 260526.
- I. Prior to concrete placement, seal duct system connections and openings with duct tape or manufacturer's recommended compound to prevent entry of concrete.
- J. Install service fittings after installation of floor finishes. Cut floors according to manufacturer's instructions as required.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect duct system components for damage and defects.
- C. Service Fittings: Test each wiring device to verify operation and proper polarity.
- D. Correct wiring deficiencies and replace damaged or defective duct system components.
- E. Repair or replace floors damaged as a result of work of this section.

3.04 ADJUSTING

- A. Adjust duct system covers to eliminate movement and noise under normal traffic.

3.05 CLEANING

- A. After concrete placement and before installation of conductors and cables, clean interior of duct system to remove moisture and foreign matter.
- B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 PROTECTION

- A. Prior to concrete placement, do not use installed duct system as walkway or working platform.
- B. Protect installed duct system from subsequent construction operations. Do not allow equipment or heavy traffic over the duct system without using ramps that ensure load is not transferred to the duct.

END OF SECTION

SECTION 260548
VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vibration isolation requirements.
- B. Seismic control requirements.
- C. Vibration-isolated equipment support bases.
- D. Vibration isolators.
- E. External seismic snubber assemblies.
- F. Seismic restraint systems.

1.02 REFERENCE STANDARDS

- A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.

1.04 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with applicable building code.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

- A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing electrical equipment and/or electrical connections to vibration-isolated equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- C. General Requirements:
 - 1. Select vibration isolators to provide required static deflection.
 - 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
- D. Conduit Isolation:
 - 1. Use flexible conduit or cable for electrical connections to vibration-isolated equipment, including equipment installed under other sections or by others.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install products in accordance with applicable requirements of NECA 1 (general workmanship).
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC(ICC-ES) evaluation report conditions of use where applicable.
- D. Secure fasteners according to manufacturer's recommended torque settings.
- E. Install flexible conduit and cable connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
- F. Vibration Isolation Systems:
 - 1. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
 - 2. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
 - 3. Adjust isolators to be free of isolation short circuits during normal operation.
 - 4. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

END OF SECTION

SECTION 260943 - NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.1 Summary

- .1 Section includes a networked lighting control system comprised of the following components:
 - .1 System Software Interfaces
 - .1 Management Interface
 - .2 Visualization Interface
 - .3 Smartphone Programming Interface for Wired Devices
 - .4 Smartphone Programming Interface for Wireless Devices
 - .2 System Backbone and Integration Equipment
 - .1 System Controller
 - .2 Digital Time Clock
 - .3 Wired Networked Devices
 - .1 Wall Stations
 - .2 Graphic Wall Stations
 - .3 Digital Key Switches
 - .4 Auxiliary Input/Output Devices
 - .5 Occupancy and Photocell Sensors
 - .6 Wall Switch Sensors
 - .7 Embedded Sensors
 - .8 Power Packs and Secondary Packs
 - .9 Networked Luminaires
 - .10 Relay and Dimming Panel
 - .11 Bluetooth® Low Energy Programming Device
 - .12 Communication Bridge
 - .13 Wired Distributed Low-Voltage Luminaires
 - .4 Wireless Networked Devices
 - .1 Wireless Networked Wall Switches, Dimmers
 - .2 Wireless Networked Auxiliary Fixture Control Devices

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- .3 Wireless Networked Indoor Occupancy and Photosensors
 - .4 Wireless Networked Outdoor Occupancy and Photosensors
 - .5 Wireless Networked Indoor Embedded Sensors
 - .6 Wireless Networked Power Packs
 - .7 Wireless Networked Luminaires
- .2 The networked lighting control system shall meet all the characteristics and performance requirements specified herein.
 - .3 The contractor shall provide, install and verify proper operation of all equipment necessary for proper operation of the system as specified herein and as shown on applicable drawings.

1.2 Submittals

- .1 Submittal shall be provided including the following items.
 - .1 Bill of Materials necessary to install the networked lighting control system.
 - .2 Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.
 - .3 Riser Diagrams showing device wiring connections of system backbone and typical per room/area type.
 - .4 Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.
 - .5 Other Diagrams and Operational Descriptions – as needed to indicate system operation or interaction with other system(s).
 - .6 Contractor Startup/Commissioning Worksheet (must be completed prior to factory start-up).
 - .7 Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.
 - .8 Hardware and Software Operation Manuals.

1.3 Approvals

- .1 Prior approval from owner's representative is required for products or systems manufactured by companies not specified in the Network Lighting Controls section of this specification.
- .2 Any alternate product or system that has not received prior approval from the owner's representative at least 10 days prior to submission of a proposal package shall be rejected.
- .3 Alternate products or systems require submission of catalog datasheets, system overview documents and installation manuals to owner's representative.

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- .4 For any alternate system that does not support any form of wireless communication to networked luminaires, networked control devices, networked sensors, or networked input devices, bidders shall provide a total installed cost including itemized labor costs for installing network wiring to luminaires, control devices, sensors, input devices and other required system peripherals.

1.4 Quality Assurance

- .1 Product Qualifications
 - .1 System electrical components shall be listed or recognized by a nationally recognized testing laboratory (e.g., UL, ETL, or CSA) and shall be labeled with required markings as applicable.
 - .2 System shall be listed as qualified under DesignLights Consortium Networked Lighting Control System Specification V5.0 or later.
 - .3 System luminaires and controls shall be certified by the manufacturer to have been designed, manufactured, and tested for interoperability.
 - .4 All components shall be subjected to 100% end of line testing prior to shipment to the project site to ensure proper device operation.
 - .5 All components and the manufacturing facility where product is manufactured shall be RoHS compliant.
- .2 Installation and Startup Qualifications
 - .1 System startup shall be performed by qualified personnel approved or certified by the manufacturer.
- .3 Service and Support Requirements
 - .1 Phone Support: Toll-free technical support shall be available. The manufacturer shall provide an online tool to schedule a technical support appointment. Manufacturer shall provide 24/7 emergency support.
 - .2 Remote Support: The manufacturer shall offer remote support capability and the ability to virtually connect with customers to address issues with visual guidance overlaid on images of real-world objects. Cellular connectivity to a networked lighting control systems shall be optionally available to provide remote support within the continental United States.
 - .3 Onsite Support: The manufacturer shall offer onsite support that is billable.
- .4 Service Contracts:
 - .1 The manufacturer shall be capable of providing service contracts for continued support of the lighting control system post installation, including:
 - .1 Remote and onsite emergency response based on first availability
 - .2 Remote system performance checks
 - .3 Remote diagnostics

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- .4 Replacement parts
- .5 The manufacturer shall be capable of providing a 72-hour, onsite response time within the continental United States if required.

1.5 Lighting Control Manufacturer Policies

- .1 Shall provide a clear and documented method to contact them regarding a vulnerability and should have a dedicated Product Security Incident Response function.
- .2 Shall build its security risk, governance and compliance infrastructure leveraging standards-derived policies, industry best practices and guidelines.
- .3 Shall make available a written description or provide documentation describing a security vulnerability policy.
- .4 Shall make available a written description or provide documentation describing a security response plan.
- .5 Shall make available a means to accept external security vulnerability notifications.
- .6 Shall reply within two business days of receiving a vulnerability notification.
- .7 Shall be SOC 2 Type 1 or Type 2 compliant.

1.6 Project Conditions

- .1 Only install indoor equipment after the following site conditions are maintained:
 - .1 Ambient Temperature: 14 to 105 degrees F (-10 to 40 degrees C)
 - .2 Relative Humidity: less than 90% non-condensing
- .2 Equipment shall not be subjected to dust, debris, moisture, or temperature and humidity conditions exceeding the requirements indicated above or as marked on the product, at any point prior to installation.
- .3 Only properly rated equipment and enclosures, installed per the manufacturer's instructions, may be subjected to dust and moisture following installation.

1.7 Warranty

- .1 The manufacturer shall provide a minimum five-year warranty on all hardware devices supplied and installed. Warranty coverage shall begin on the date of shipment.
- .2 The hardware warranty shall cover repair or replacement of any defective products within the warranty period.

1.8 Maintenance & Sustainability

- .1 The manufacturer shall make available to the owner new parts, upgrades, and/or replacements available for a minimum of 5 years following installation.

PART 2 - EQUIPMENT

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2.1 Manufacturers

- .1 Acceptable Manufacturers
- .2 Acuity Brands Lighting, Inc.
- .3 Basis of Design System: Acuity Controls n Light

2.2 System Compliance

- .1 System components shall comply with UL 916 and UL 924 standards where applicable.
- .2 System components shall comply with CFR Title 47, Part 15 standards where applicable.
- .3 System components shall comply with ISED Canada RSS-247 standards where applicable.
- .4 All equipment shall be installed and connected in compliance with NFPA 70.

2.3 System Performance Requirements

- .1 System Architecture
 - .1 System shall have an architecture that is based upon three main concepts: (1) networkable intelligent lighting control devices, (2) standalone lighting control zones using distributed intelligence, (3) optional system backbone for remote, time based and global operation.
 - .2 Intelligent lighting control devices shall have individually addressable network communication capability and consist of one or more basic lighting control components: occupancy sensor, photocell sensor, relay, dimming output, contact closure input, analog 0-10V input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.
 - .3 System must be capable of interfacing directly with networked luminaires such that either low voltage network cabling or wireless RF communication is used to interconnect networked luminaires with control components such as sensors, switches and system backbone (see *Control Zone Characteristics* sections for each type of network connection, wired or wireless).
 - .4 Networked luminaires and intelligent lighting control devices shall support individual (unique) configuration of device settings and properties, with such configuration residing within the networked luminaires and intelligent control devices.

- .5 Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices and shall be capable of providing automatic control from sensors (occupancy and/or photocell) and manual control from local wall stations without requiring connection to a higher-level system backbone; this capability is referred to as “distributed intelligence.”
 - .1 Lighting control zones (wired and wireless) of at least 128 devices per zone shall be supported.
- .6 Networked luminaires and intelligent lighting control devices shall have distributed intelligence programming stored in non-volatile memory, such that following any loss of power the lighting control zones shall operate according to their defined default settings and sequence of operations.
- .7 Lighting control zones shall be capable of being networked with a higher-level system backbone to provide time based control, remote control from inputs and/or systems external to the control zone, and remote configuration and monitoring through a software interface.
- .8 The system may include one or more system controllers that provide time-based control. The system controller also provides a means of connecting the lighting control system to a system software interface and building management systems via BACnet/IP or BACnet MS/TP protocol.
- .9 All system devices shall support firmware update, either remotely or from within the applications space, for purposes of upgrading functionality at a later date.
- .10 System shall be capable of reporting lighting system events and performance data to management software for display and analysis.
- .2 Wired Networked Control Zone Characteristics
 - .1 Connections to devices within a wired networked lighting control zone and to backbone components shall be with a single type of low voltage network cable, which shall be compliant with CAT5e specifications or higher. To prevent wiring errors and provide cost savings, the use of mixed types of low voltage network cables shall not be permitted.
 - .2 Devices in an area shall be connected via a “daisy-chain” topology. “Hub-and- spoke” topology, requiring all individual networked devices to be connected back to a central component, shall not be permitted, so as to reduce the total amount of network cable required for each control zone.
 - .3 System shall provide the option of having pre-terminated plenum rated low voltage network cabling supplied with hardware to reduce the opportunity for improper wiring and communication errors during system installation.
 - .4 Following proper installation and provision of power, all networked devices connected with low voltage network cable shall automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g. software application, handheld remote, pushbutton).

- .1 The “out of box” default sequence of operation is intended to provide typical sequence of operation to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.
- .5 Once software is installed, system shall be able to automatically discover all connected devices without requiring any provisioning of system or zone addresses.
- .6 All networked devices shall have the ability to detect improper communication wiring and blink its LED in a specific cadence as to alert installation/startup personnel.
- .7 Networked control devices intended for control of egress and/or emergency light sources shall not require the use of additional, externally mounted UL924 shunting and/or 0-10V disconnect devices, so as to provide a compliant sequence of operation while reducing the overall installation and wiring costs of the system. The following types of wired networked control devices shall be provided for egress and/or emergency light fixtures:
 - .1 Low-Voltage power sensing: These devices shall automatically provide 100% light level upon detection of loss of power sensed via the low voltage network cable connection.
 - .2 UL924 Listed Line-Voltage power sensing: These devices shall be listed as emergency relays under the UL924 standard, and shall automatically close the load control relay and provide 100% light output upon detection of loss of power sensed via line voltage connection to normal power.
- .8 Networked luminaires and intelligent lighting control devices located in different areas shall be able to transmit and track information within at least 128 system- wide control zones to support required sequences of operation that may span across multiple areas. Occupancy and photocell commands shall be available across a single controller, and switch commands shall be available across single or multiple controllers. These shall also be referred to as global control zones.
- .9 Wired networked Wall stations shall provide the follow Scene Control Capabilities:
 - .1 Preset Scenes that can activate a specific combination of light levels across multiple local and global channels, as required.
 - .2 Profile Scenes that can modify the sequence of operation for the devices in the area (group) in response to a button press. This capability is defined as supporting “Local Profiles” and is used to dynamically optimize the occupant experience and lighting energy usage.
 - .1 Wall stations shall be able to manually start and stop Local Profiles, or the local profile shall be capable of ending after a specific duration of time between 5 minutes and 12 hours.

- .2 Parameters that shall be configurable and assigned to a Local Profile shall include, but not be limited to, fixture light level, occupancy time delay, response to occupancy sensors (including enabling/disabling response), response to daylight sensors (including enabling/disabling response), and enabling/disabling of wall stations.
 - .3 3-way / multi-way control: multiple wall stations shall be capable of controlling the same local and global control zones, so as to support “multi-way” preset scene and profile scene control.
- .3 Wireless Networked Control Zone Characteristics
- .1 No wired connections between networked devices shall be required for the purposes of system communications.
 - .2 Multiple wireless networking protocols shall be supported:
 - .1 A standards based, distributed star topology type of protocol for 900 MHz communication, so as to support lighting control applications and IoT applications.
 - .2 A Bluetooth standard protocol for 2.4 GHz communication that supports direct connection to a smartphone and tablet device, so as to support device configuration, control applications, and IoT without requiring the use of a system backbone.
 - .3 Wireless network shall be self-healing, such that the loss of backbone or local communication between devices does not result in the loss of local control of the lights in the space.
 - .4 Wireless network communication shall support uniform and instant response such that all luminaires in a lighting control zone respond immediately and synchronously in response to a sensor or wall station signal.
 - .5 To support the system architecture requirement for distributed intelligence, wireless network communication shall support communication of control signals from sensors and wall stations to networked luminaires and wireless load control devices, without requiring any communication, interpretation, or translation of information through a backbone device such as a wireless access point, communication bridge or gateway.
 - .6 All wireless communication between lighting control components shall support the following five tiers of security measures.
 - .1 Data Encryption
 - .2 Firmware Protection
 - .3 Tamper-Proof Hardware
 - .4 Authenticated User Access
 - .5 Mutual Device Authentication

- .7 Wireless devices shall use AES encryption to secure communication. A unique encryption key shall be generated for each programmed site.
- .8 Wireless devices shall use signed firmware to ensure that unmodified, authentic software is always installed.
- .9 Accounting for typical environmental conditions and building construction materials encountered within commercial indoor lighting environments, wireless networked devices shall be capable of communicating to at least 150' spacing between devices with embedded wireless transceivers under typical site conditions.
- .10 Wireless networked devices shall have a line-of-sight communication range of at least 1,000' under ideal environmental conditions.
- .11 Wireless devices shall self-identify when communication to the system controller cannot be accomplished or when communication to the system controller is lost.
 - .1 This capability shall be available for all wireless relays, sensors, and luminaire-integrated devices that are not powered by batteries.
 - .2 This capability shall not be required for wireless switches or battery powered devices.
- .12 Wireless devices shall self-establish connection of other devices to a system controller if direct communication cannot be accomplished or when communication to the system controller is lost.
 - .1 The path for communication shall utilize existing, wireless networked devices that are located between a system controller and respective end devices.
 - .2 Installation of additional hardware for formation of a networked communication path between a system controller and end devices shall not be required.
 - .3 This capability shall be available for all wireless relays, sensors, and luminaire-integrated devices that are not powered by batteries.
 - .4 This capability shall not be required for wireless switches or battery powered devices.
- .4 System Integration Capabilities
 - .1 The system shall interface with third party building management systems (BMS) to support two-way communication using the industry standard BACnet/IP protocol, BACnet MS/TP protocol, and RESTful API. The following system integration capabilities shall be available:
 - .1 The system shall support "write" messages for control of individual devices, including, but not limited to, control of relay and dimming output.
 - .2 The system shall support "write" messages for control of groups of devices through a single command, including, but not limited to, control of relay and dimming output of all devices.

- .3 The system shall support reading of individual device status information.
 - .1 The available status will depend on the individual device type and capabilities, which may include but not be limited to, relay state, dimming output, power measurement, occupancy sensor status, and photocell light measurement.
 - .2 All system devices shall be available for polling for devices status.
- .4 The system shall support reading of group status information for occupancy, relay state, and dimming output.
- .5 The system shall support activation of pre-defined system Global Profiles (see *Supported Sequence of Operations for further definition of Global Profile capabilities*).
- .2 The system shall support activation of Global Profiles from third party systems by receiving dry contact closure output signals or digital commands via RS-232/RS-485. (See *Supported Sequence of Operations for further definition of Profile and Scene Preset capabilities*.)
- .3 The system shall support activation of demand response levels from Demand Response Automation Servers (DRAS) via the OpenADR 2.0a protocol.
- .5 Supported Sequence of Operations
 - .1 Control Zones
 - .1 Networked luminaires and intelligent lighting control devices installed in an area (also referred to as a group of devices) shall be capable of transmitting and tracking occupancy sensor, photocell sensor, and manual switch information within at least 48 unique control zones to support different and reconfigurable sequences of operation within the area. These shall also be referred to as local control zones.
 - .2 Networked luminaires and intelligent lighting control devices shall include the ability to track occupancy broadcasts from adjacent zones. When this feature is enabled, luminaire output for a vacant zone will reduce to a configurable dimmed state if one or more adjacent zones are occupied. Luminaires will turn off when both primary and adjacent zones are vacant.
 - .2 Wall station Capabilities
 - .1 Wall stations shall be provided to support the following capabilities:
 - .a On/Off of a local control zone.
 - .b Continuous dimming control of light level of a local control zone.
 - .2 3-way / multi-way control: multiple wall stations shall be capable of controlling the same local control zones, so as to support “multi-way” switching and/or dimming control.
 - .3 Occupancy Sensing Capabilities

- .1 Occupancy sensors shall be configurable to control a local zone.
- .2 Multiple occupancy sensors shall be capable of controlling the same local zones. This capability combines occupancy sensing coverage from multiple sensors without consuming multiple control zones.
- .3 System shall support the following types of occupancy sensing sequence of operations:
 - .a On/Off Occupancy Sensing
 - .b Partial-On Occupancy Sensing
 - .c Partial-Off Occupancy Sensing
 - .d Vacancy Sensing (Manual-On / Automatic-Off)
- .4 On/Off, Partial-On, and Partial-Off Occupancy Sensing modes shall function according to the following sequence of operation:
 - .a Occupancy sensors shall automatically turn lights on to a designated level when occupancy is detected. To support fine tuning of Partial-On sequences the designated occupied light level shall support at least 100 dimming levels.
 - .b Occupancy sensors shall automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. To support fine tuning of Partial-Off sequences the designated unoccupied dim level shall support at least 100 dimming levels.
 - .c To provide additional energy savings the system shall also be capable of combining Partial-Off and Full-Off operation by dimming the lights to a designated level when vacant and then turning the lights off completely after an additional amount of time.
 - .d Photocell readings, if enabled in the Occupancy Sensing control zone, shall be capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary to further reduce energy usage. Additional requirements and details for photocell sensing capabilities are indicated under *Photocell Sensing Capabilities*.
 - .e The use of a wall station shall change the dimming level or turn lights off as selected by the occupant. The lights shall optionally remain in this manually-specified light level until the zone becomes vacant; upon vacancy the normal sequence of operation, as defined above, shall proceed.
- .5 Vacancy Sensing mode (also referred to as Manual-On / Automatic-Off) shall function according to the following sequence of operation:
 - .a The use of a wall station is required to turn lights on. The system shall be capable of programming the zone to turn on to either to a designated light level or the previous user light level. Initially occupying the space without using a wall station shall not result in lights turning on.

- .b Occupancy sensors shall automatically turn lights off or to adimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. To support fine tuning of Partial-Off sequences the designated unoccupied dim level shall support at least 100 dimming levels.
 - .c To provide additional energy savings and an enhanced occupant experience, the system shall also be capable of dimming the lights when vacant and then turning the lights off completely after an additional amount of time.
 - .d To minimize occupant impact in case the area or zone is still physically occupied following dimming or shutoff of the lights due to detection of vacancy, the system shall support an “automatic grace period” immediately following detection of vacancy, during which time any detected occupancy shall result in the lights reverting to the previous level. After the grace period has expired, the use of a wall station is required to turn lights on.
 - .e Photocell readings, if enabled in the Occupancy Sensing control zone, shall be capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary to further reduce energy usage. Additional requirements and details for photocell sensing capabilities are indicated under *Photocell Sensing Capabilities*.
 - .f At any time, the use of a wall station shall change the dimming level or turn lights off as selected by the occupant. The lights shall optionally remain in this manually-specified light level until the zone becomes vacant; upon vacancy the normal sequence of operation, as defined above, shall proceed.
- .6 To accommodate diverse types of environments, occupancy time delays before dimming or shutting off lights shall be specifiable for control zones between 15 seconds to 2 hours.
- .4 Photocell Sensing Capabilities (Automatic Daylight Sensing)
- .1 Photocell sensing devices shall be configurable to control a local zone.
 - .2 The system shall support the following type of photocell-based control:
 - .a Continuous Dimming: The control zone automatically adjusts its dimming output in response to photocell readings, such that a minimum light level consisting of both electric light and daylight sources is maintained at the task. The photocell response shall be configurable to adjust the photocell setpoint and dimming rates.
- .5 Schedule Capabilities
- .1 System shall support the creation of time schedules for time-of-day override of devices including offsets from dusk and dawn.
 - .2 System shall support blink warning and timed extension capabilities.

- .1 The system shall be capable of providing a visible “blink warning” 5 minutes prior to the end of the schedule.
 - .2 Wall stations may be programmed to provide timed extensions/overrides that turn the lights on for an additional period of time.
 - .1 Timed override/extension duration shall be programmable for each individual device, zone of devices, or customized group of devices, ranging from 5 minutes to 12 hours.
- .6 Global Profile Capabilities
- .1 The system shall be capable of automatically modifying the sequence of operation for selected devices in response to any of the following: a time-of- day schedule, contact closure input state, manually triggered wired wall station input, RS-232/RS-485 command to wired input device, and BACnet input command. This capability is defined as supporting “Global Profiles” and is used to dynamically optimize the occupant experience and lighting energy usage.
 - .2 Global profiles may be scheduled with the following capabilities:
 - .a Global Profiles shall be stored within and executed from the system controller (via internal timeclock) such that a dedicated software host or server is not required to be online to support automatic scheduling and/or operation of Global Profiles.
 - .b Global Profile time-of-day schedules shall be capable of being given the following recurrence settings: daily, specific days of week, every “n” number of days, weekly, monthly, and yearly. Lighting control profile schedules shall support definition of start date, end date, end after “n” recurrences, or never ending. Daylight savings time adjustments shall be capable of being performed automatically, if desired.
 - .c Global Profile Holiday Schedules should follow recurrent settings for specific US holiday dates regardless if they always occur on a specific date or are determined by the day/week of the month.
 - .d Global Profiles shall be capable of being scheduled to run according to timed offsets relative to sunrise or sunset. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.
 - .e Software management interface shall be capable of displaying a graphic calendar view of profile schedules for each control zone.
 - .3 System Global Profiles shall have the following additional capabilities:
 - .a Global Profiles shall be capable of being manually activated directly from the system controller, specially programmed wired input devices, scene capable wired wall stations, and the software management interface.

- .b Global Profiles shall be selectable to apply to a single device, zone of devices, or customized group of devices.
 - .c Parameters that shall be configurable and assigned to a Global Profile shall include, but not be limited to, fixture light level, occupancy time delay, response to occupancy sensors (including enabling/disabling response), response to daylight sensors (including enabling/disabling response), and enabling/disabling of wallstations.
- .4 A backup of Local and Global Profiles shall be stored on the software's host server such that the Profile backup can be applied to a replacement system controller or wired wall station.
- .7 System shall support automated demand response capabilities with automatic reduction of light level to at least three levels of demand response, configurable for each output device.

2.4 System Software Interfaces

.1 Management Interface

- .1 System shall provide a web-based management interface that provides remote system control, live status monitoring, and configuration capabilities of lighting control settings and schedules.
- .2 Management interface must be compatible with industry-standard web browser clients, including, but not limited to, Microsoft Internet Explorer®, Apple Safari®, Google Chrome®, Mozilla Firefox®.
- .3 Management interface shall require all users to login with a User Name and Password, and shall support creation of at least 100 unique user accounts.
- .4 Management interface shall support at least three permission levels for users: read-only, read & change settings, and full administrative system access.
- .5 Management interface shall be capable of restricting access for user accounts to specific devices within the system.
- .6 All system devices shall be capable of being given user-defined names.
- .7 The following device identification information shall be displayed in the Management interface: model number, model description, serial number or network ID, manufacturing date code, custom label(s), and parent network device.
- .8 Management interface shall be able to read the live status of a networked luminaire or intelligent control device and shall be capable of displaying luminaire on/off status, dim level, power measurement, device temperature, PIR occupancy sensor status, microphonic occupancy sensor status, remaining occupancy time delay, photocell reading, and active Profiles.

- .9 Management interface shall be able to read the current active settings of a networked luminaire or intelligent control device and shall be capable of displaying dimming trim levels, occupancy sensor and photocell enable/disable, occupancy sensor time delay and light level settings, occupancy sensor response (normal or vacancy), and photocell setpoints and transition timedelays.
 - .10 Management interface shall be able to change the current active settings and default settings for an individual networked luminaire or intelligent control device.
 - .11 Management interface shall be capable of applying settings changes for a zone of devices or a group of selected devices using a single “save” action that does not require the user to save settings changes for each individual device.
 - .12 A printable network inventory report shall be available via the management interface.
 - .13 A printable report detailing all system profiles shall be available via the management interface.
 - .14 All sensitive information stored by the software shall be encrypted.
 - .15 All system software updates must be available for automatic download and installation via the internet.
- .2 System Energy Analysis & Reporting Software:
- .1 Intuitive graphical screens shall be displayed in order to facilitate simple viewing of system energy performance.
 - .2 An “Energy Scorecard” shall be display that shows calculated energy savings in dollars or KWh.
 - .3 Software shall calculate the allocation of energy savings to different control measures (occupancy sensors, photocells, manual switching, etc).
 - .4 Energy savings data shall be calculated for the system as a whole.
 - .5 A time scaled graph showing all relay transitions shall be presented.
 - .6 A time scaled graph showing a zones occupancy time delay shall be presented.
 - .7 A time scaled graph showing the total light level shall be presented.
 - .8 Software shall be capable of storing information remotely onto an open-source, object-relational database, such as PostgreSQL.
 - .9 Data stored in the database shall be accessed utilizing an open standard, application programming interface, such as Open Database Connectivity (ODBC).
- .3 Visualization and Programming Interfaces
- .1 System shall provide an optional web-based visualization interface that displays graphical floorplan.

- .2 Graphical floorplan shall offer the following types of system visualization:
 - .1 Full Device Option - A master graphic of the entire building, by floor, showing each control device installed in the project with zones outlined. This shall include, but not be limited to, the following:
 - .1 Controls embedded light fixtures
 - .2 Controls devices not embedded in light fixtures
 - .3 Daylight Sensors
 - .4 Occupancy Sensors
 - .5 Wall Switches and Dimmers
 - .6 Scene Controllers
 - .7 Networked Relays
 - .8 Wired Bridges
 - .9 System Controllers
 - .10 Wired Relay Panels
 - .11 Group outlines
 - .2 Group Only Option - A master graphic of the entire building, by floor, showing only control groups outlined.
 - .3 Allow for pan and zoom commands so smaller areas can be displayed on a larger scale simply by panning and zooming each floor's master graphic.
 - .4 A mouse click on any control device shall display the following information (as applicable):
 - .1 The device catalog number.
 - .2 The device name and custom label.
 - .3 Device diagnostic information.
 - .4 Information about the device status or current configuration is available with an additional mouse click.
- .3 Programming capabilities through the application shall include the following:
 - .1 Switch/occupancy/photosensor zone configuration
 - .2 Manual/automatic on modes
 - .3 Turn-on dim level
 - .4 Occupancy sensor time delays
 - .5 Dual technology occupancy sensors sensitivity

- .6 Photosensor calibration adjustment and auto-setpoint
- .7 Multiple photosensor zone offset
- .8 Trim level settings
- .9 Preset scene creation and copy for scene capable devices.
- .10 Application of custom device labels to the Bluetooth Low Energy Programming Devices and individual connected lighting control devices.

- .4 Smartphone Programming Interface for Wireless Devices
 - .1 Application interface shall be provided for both Apple iOS® and Android operating systems that allows configuration of lighting control settings.
 - .2 The application shall support the configuration of wireless networked control devices.
 - .1 Application shall limit access with a user name and password.
 - .2 Access to the program information will be governed by a permission system that allows users to share access with other users and restrict access to those who should not be able to reconfigure the equipment.
 - .3 The application shall provide indication of signal strength where multiple Bluetooth Low Energy Programming Devices are available for configuration.
 - .3 Programming capabilities through the application shall include, but not be limited to, the following:
 - .1 Switch/occupancy/photosensor group configuration
 - .2 Manual/automatic on modes
 - .3 Turn-on dim level
 - .4 Occupancy sensor time delays
 - .5 Dual technology occupancy sensors sensitivity
 - .6 Photosensor calibration adjustment and auto-setpoint
 - .7 Multiple photosensor zone offset
 - .8 Trim level settings

2.5 System Backbone and System Integration Equipment

- .1 System Controller
 - .1 Product Series: nECY
 - .2 System Controller shall be a multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.

- .3 System Controller shall have 32-bit microprocessor operating at a minimum of 1 GHz.
- .4 System Controller shall have minimum of 512MB memory, with a minimum of 4GB non-volatile flash, to support its own operating system and databases.
- .5 System Controller shall perform the following functions:
 - .1 Time-based control of downstream wired and wireless network devices.
 - .2 Linking into an Ethernet network.
 - .3 Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.
 - .4 Connection to various software interfaces, including management interface, historical database and analytics interface, and visualization interface.
- .6 System Controller shall have an integral web server to support system controller configuration and diagnostics and shall optionally support control and visualization of connected devices.
 - .1 Web server shall optionally provide a control interface, accessed via connection to the system controller.
 - .1 Control Interface shall support representation of all devices associated with the system controller and shall support control of all output-capable devices.
 - .2 Control Interface shall optionally support representation of devices in a space via a graphical floorplan.
 - .3 Control Interface shall support control of output-capable devices through virtual sliders, toggle buttons, preset level widgets, and transparent layers on a graphical floorplan.
 - .4 Control Interface shall support the following types of control capabilities:
 - .1 Control of individual output devices, including control of relay state and analog dimming level where applicable.
 - .2 Control of local lighting control zones, including control of relay state and analog dimming level where applicable.
 - .3 Control of global lighting control zones, including control of relay state and analog dimming level where applicable.
 - .4 Control of Global Profiles.
 - .2 Web server shall optionally provide a visualization interface for viewing device property statuses.

- .1 Visualization interface shall support the ability to superimpose colored, transparent layers representing real-time property values, including occupancy status, dimming level status, light level status, and online or offline status where applicable.
- .2 Visualization interface shall support ad hoc display of trended information via an intuitive values-over-time graph.
- .3 Visualization interface shall support creation of reports.
 - .1 Reports shall accept and graphically display trended status datasets for creator selected devices or zones of devices.
 - .2 Report information shall be displayed over a user-defined interval and date range.
 - .3 Reports shall be exportable to a standard CSV format.
- .7 Device shall have option for a graphical touch screen to support configuration and diagnostics.
- .8 Device shall have three RJ-45 networked lighting control ports for connection to any of the following:
 - .1 The graphical touch screen
 - .2 Wired communication bridges
 - .3 Direct connection to networked wired luminaires and intelligent lighting control devices (up to 128 total devices per port)
- .9 Device shall automatically detect all networked devices connected to it.
- .10 Each System Controller shall be capable of managing and operating at least 750 networked devices (wired or wireless).
 - .1 Multiple System Controllers may be networked together via LAN connection to scale the system up to at least 20,000 networked devices.
- .11 System Controller shall support BACnet/IP and BACnet MS/TP protocols to directly interface with BMS and HVAC equipment without the need for additional protocol translation gateways.
 - .1 BACnet MS/TP shall support 9600 to 115200 baud rate.
 - .2 System Controller shall be BACnet Testing Laboratory (BTL listed) using Device Profile BACnet Building Controller (B-BC) with outlined enhanced features.
- .12 System controller shall contain a “FIPS 140-2 Level 1 Inside” cryptographic module.
- .13 System controller shall support RESTful API control of BACnet objects, user management, date and time, and file management.

- .14 System controller shall be available within a NEMA 1 enclosure with Class 1 and Class 2 separation. Enclosure shall support power input power of 120-277VAC, or optional 347
- .15 System controller shall eliminate redundant, wireless networked paths to streamline communication between the system controller and end devices.
- .16 System controller shall include the following security provisions.
 - .1 System controller or gateway shall disallow the use of default passwords and require passwords to be updated prior to use.
 - .2 System controller or gateway shall support user role-based access, such as administrator, user, and viewer.
 - .3 System controller or gateway shall use signed firmware to ensure that unmodified, authentic software is always installed.
 - .4 System controller or gateway communicating across an IP network shall protect in-transit data using strong encryption algorithms such as AES or TLS1.2+.
 - .5 Shall prevent rollback of firmware entirely or shall, at minimum, prevent downgrade of firmware to versions with known, critical vulnerabilities.
 - .6 System controllers or gateway shall have a valid cybersecurity listing through a third party.
- .17 System controller shall be available with a cellular router for remote access.
 - .1 Router shall support remote access to at least five system controllers on its local area network or on its network subnet.
 - .2 Remote access shall allow for device settings updates, schedule updates, system performance optimization, and diagnostics.
 - .3 Remote access shall be enabled through outbound communication from the cellular router to an outside source. Solutions that begin communication via inbound requests for network access shall not be accepted.
 - .4 Router shall support outbound communication with a manufacturer- hosted portal using TLS1.2 or greater in-transit encryption over a cellular or Ethernet connection.
 - .5 Router shall include a firewall to prevent unauthorized access to devices connected to its local area network.
 - .6 Router shall include a cellular SIM capable of connection to AT&T, T-Mobile, Sprint, US Cellular, Alaska Wireless, Telefonica, Tellus, Bell, or Sasktel networks where carrier service is available.
 - .7 Outbound communication from the router shall be limited to a whitelist of endpoints.
 - .8 Outbound communication from the router shall only include lighting control system information.

- .2 Digital Time Clock (DTC)
 - .1 DTC shall control and program a linear bus of lighting devices and supply all time functions without connection to a system controller.
 - .1 Programming of the linear bus of lighting devices shall not require additional hardware, including computers, specialized dongles, or other connection devices.
 - .2 Programming of the linear bus shall be exclusively done through the touch screen interface.
 - .2 DTC shall be capable of up to 32 schedules. Each schedule shall consist of one set of On and Off times per day for each day of the week and for each of two holiday lists. The schedules shall apply to any individual relay or group of relays.
 - .3 DTC shall be run from non-volatile memory so that all system programming is retained indefinitely.
 - .4 DTC shall be optionally mounted inside of a relay panel. Installation inside of the relay panel shall eliminate the necessity of any additional enclosures for complete installation.
 - .5 DTC shall have a capacitive 3.5” full color touch screen.

2.6 Wired Networked Devices

- .1 Wired Networked Wall Switches, Dimmers, Scene Controllers
 - .1 Product Series: nPODM, nPODM xS, nPODM xL, nPODMA, nPODMA xS, nPODMA xL.
 - .2 Devices shall recess into single-gang switch box and fit a standard GFI opening.
 - .3 Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
 - .4 All switches shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.
 - .5 Devices with mechanical push-buttons shall provide tactile and LED user feedback.
 - .6 Devices with mechanical push-buttons shall be made available with custom button labeling.
 - .7 Wall switches & dimmers shall support the following device options:
 - .1 Number of control zones: 1, 2 or 4
 - .2 Control Types Supported:
 - .a On/Off

- .b On/Off/Dimming
 - .c On/Off/Dimming/Correlated Color Temperature Control for specific luminaire types
 - .3 Colors: Ivory, White, Light Almond, Gray, Black, Red
- .8 Scene controllers shall support the following device options:
- .1 Number of scenes: 1, 2 or 4
 - .2 Control Types Supported:
 - .a On/Off
 - .b On/Off/Dimming
 - .c Preset Level Scene Type
 - .d On/Off/Dimming/Preset Level for Correlated Color Temperature
 - .e Reprogramming of other devices within daisy-chained zone so as to implement user selected lighting scene. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.
 - .f Selecting a lighting profile to be run by the system's upstream controller so as to implement a selected lighting profile across multiple zones. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12hours.
 - .3 Colors: Ivory, White, Light Almond, Gray, Black, Red
- .2 Wired Networked Graphic Wall Stations
- .1 Product Series: nPOD TOUCH
 - .2 Device shall surface mount to single-gang switch box.
 - .3 Device shall have a 3.5", capacitive full color touch screen.
 - .4 Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply.
 - .5 Device shall enable mobile application control of control zones and scenes through Bluetooth.
 - .6 Communication shall be over standard low voltage network cabling with RJ-45 connectors.
 - .7 Device shall enable user supplied screen saver image to be uploaded within one of the following formats: jpg, png, gif, bmp, tif.
 - .8 Device shall enable configuration of all switches, dimmers, control zones, and lighting preset scenes via password protected setup screens.

- .9 Graphic wall stations shall support the following device options:
 - .1 Number of control zones: Up to 16
 - .2 Number of scenes: Up to 16
 - .3 Profile type scene duration: User configurable from 5 minutes to 12 hours
 - .4 Colors: White, Black
- .3 Wired Networked Digital Key Switches
 - .1 Product Series: nPOD KEY, nPOD KEY MNTN
 - .2 Devices shall recess into single-gang switch box and fit a standard GFI opening.
 - .3 Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
 - .4 All switches shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.
 - .5 Devices shall have LED user feedback to provide indication of on/off status of the programmed lights or scene, as well as indication of device power.
 - .6 Digital key switches shall support the following device options:
 - .1 Control Types Supported:
 - .a On/Off
 - .b On/Off/Dimming
 - .c Preset Level Scene Type
 - .d Reprogramming of other devices within daisy-chained zone so as to implement user selected lighting scene. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.
 - .e Selecting a lighting profile to be run by the system's upstream controller so as to implement a selected lighting profile across multiple zones. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.
 - .2 Colors: Ivory, White, Light Almond, Stainless Steel
- .4 Wired Networked Auxiliary Input / Output (I/O) Devices
 - .1 Product Series: nIO-1S, nIO-RLX, nIO-MLO-5STEPA, nIO-MLO-AB, nIO-NLI, nIO-X, nIO-D, nIO-EZ-PH, nIO-EZD, nIO-EZDL, nIO-EZDA, nIO-EZDX, nIO-EZDCA, nIO-EZDXA, nIO-EZDCL

- .2 Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½” knockout.
- .3 Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
- .4 Auxiliary Input/Output Devices shall be specified as an input or output device with the following options:
 - .1 Contact closure or Pull High input
 - .a Input shall be programmable to support maintained or momentary inputs that can activate local or global scenes and profiles, activate lights at a preconfigured level, ramp light level up or down, or toggle lights on/off.
 - .2 0-10V analog input
 - .a Input shall be programmable to function as a daylight sensor.
 - .3 RS-232/RS-485 digital input
 - .a Input supports activation of up to 4 local or global scenes and profiles, and on/off/dimming control of up to 16 local control zones.
 - .4 0-10V dimming control output, capable of sinking up to 20mA of current
 - .a Output shall be programmable to support all standard sequence of operations supported by system.
 - .5 Digital control output via EldoLED LEDcode communication
 - .a Output shall be programmable to support light intensity control, as well as optional correlated color temperature (CCT) control, of the connected luminaire.
- .5 Wired Networked Occupancy and Photosensors
 - .1 Product Series: nCM, nCMB, nRM, nWV, nHW
 - .2 Occupancy sensors shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
 - .3 Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state, thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.
 - .4 For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional “dual” technology shall be used.
 - .5 Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.

- .6 All sensing technologies shall be acoustically passive, meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers and hearing devices). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonic technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.
 - .7 System shall have ceiling, fixture, recessed & corner mounted sensors available, with multiple lens options available customized for specific applications.
 - .8 Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
 - .9 All sensors shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.
 - .10 Sensor programming parameter shall be available and configurable remotely from the software and locally via the device push-button.
 - .11 Ceiling mount occupancy sensors shall be available with zero or one integrated dry contact switching relays, capable of switching 1 amp at 24 VAC/VDC (resistive only).
 - .12 Sensors shall be available with one or two occupancy “poles”, each of which provides a programmable time delay.
 - .13 Sensors shall have optional features for photosensor/daylight override, automatic dimming control, and low temperature/high humidity operation.
 - .14 Photosensor shall provide for an on/off set-point, and a dead band to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
 - .15 Photosensor and dimming sensor’s set-point and dead band shall be automatically calibrated through the sensor’s microprocessor by initiating an “Automatic Set-point Programming” procedure. Min and max dim settings as well as set-point may be manually entered and/or modified.
 - .16 Dead band setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
 - .17 A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The secondary daylight zone shall be capable of being controlled as an “offset” from the primary zone.
- .6 Wired Networked Wall Switch Sensors
- .1 Product Series: nWSX LV, nWSXA LV
 - .2 Devices shall recess into single-gang switch box and fit a standard GFI opening.

- .3 Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
- .4 All wall switch sensors shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.
- .5 Devices with mechanical push-buttons shall provide tactile user feedback.
- .6 Wall switch sensors shall support the following device options:
 - .1 User Input Control Types Supported: On/Off or On/Off/Dimming
 - .2 Occupancy Sensing Technology: PIR only or Dual Tech acoustic
 - .3 Daylight Sensing Option: Inhibit Photosensor
 - .4 Colors: Ivory, White, Light Almond, Gray, Black, Red
- .7 Wired Networked Embedded Sensors
 - .1 Product Series: nES
 - .2 Network system shall have embedded sensors consisting of occupancy sensors and/or dimming photocells that can be embedded into luminaire such that only the lens shows on luminaire face.
 - .3 Occupancy sensor detection pattern shall be suitable for 7.5' to 20' mounting heights.
 - .4 Embedded sensors shall support the following device options:
 - .1 Occupancy Sensing technology: PIR only or Dual Tech acoustic
 - .2 Daylight Sensing Option: Occupancy only, Daylight only, or combination Occupancy/Daylight sensor
- .8 Wired Networked Power Packs and Secondary Packs
 - .1 Product Series: nPP16, nPP16-ER, nPP20-PL, nSP16, nSP5-PCD, nSP5-2P- LVR, nSHADE, nAR40, nEPS-60, nPS-80
 - .2 Power Packs shall incorporate one optional Class 1 relay, optional 0-10 VDC dimming output, and contribute low voltage Class 2 power to the rest of the system.
 - .3 Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC) and carry a plenum rating.
 - .4 Secondary Packs shall incorporate the relay and 0-10 VDC or line voltage dimming output, but shall not be required to contribute system power.
 - .5 Power Supplies shall provide system power only, but are not required to switch line voltage circuit.

- .6 Auxiliary Relay Packs shall switch low voltage circuits only, capable of switching 1 amp at 40 VAC/VDC (resistive only).
- .7 Communication shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors. Secondary packs shall receive low voltage power via standard low voltage network cable.
- .8 Power Pack programming parameters shall be available and configurable remotely from the software and locally via the device push-button.
- .9 Power Pack shall securely mount through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast/driver channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wireleads.
Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
- .10 When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
- .11 Power/Secondary Packs shall be available with the following options:
 - .1 Power Pack capable of full 16-Amp switching of all normal power lighting load types, with optional 0-10V dimming output capable of up to 100mA of sink current.
 - .2 Secondary Pack with UL924 listing for switching of full 16-Amp Emergency Power circuits, with optional 0-10V dimming output capable of up to 100mA of sink current.
 - .3 Power and Secondary Packs capable of full 20-Amp switching of general purpose receptacle (plug-load) control.
 - .4 Secondary Pack capable of full 16-Amp switching of all normal power lighting load types.
 - .5 Secondary Pack capable of 5-Amps switching and dimming 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).
 - .6 Secondary Pack capable of 5-Amps switching and dimming of 120/277 VAC magnetic low voltage transformers.
 - .7 Secondary Pack capable of 4-Amps switching and dimming of 120 VAC electronic low voltage transformers.
 - .8 Secondary Pack capable of louver/damper motor control for skylights.
 - .9 Secondary Pack capable of providing a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.

- .10 Secondary Pack capable of switching 1 amp at 40 VAC/VDC (resistive only) with the intent to provide relay signal to auxiliary system(e.g. BMS).
 - .11 Power Supply capable of providing auxiliary bus power (no switched or dimmed load).
- .9 Wired Networked Luminaires
- .1 Networked luminaires shall have a mechanically integrated control device.
 - .2 Networked LED luminaires shall have two RJ-45 ports available (via control device directly or incorporated RJ-45 splitter).
 - .3 Networked LED luminaires shall be able to digitally network directly to other network control devices (sensors, photocells, switches, dimmers).
 - .4 Networked LED luminaires shall provide low voltage power to other networked control devices (excluding EMG and CCT capable versions).
 - .5 System shall be able to turn on/off specific LED luminaires without using a relay, if LED driver supports “sleep mode.”
 - .6 System shall be able to maintain constant lumen output over the specified life of the LED luminaire (also called lumen compensation) by automatically varying the dimming control signal to account for lumen depreciation.
 - .1 System shall indicate (via a blink warning) when the LED luminaire is no longer able to compensate for lumen depreciation.
 - .7 System shall be able to provide control of network luminaire intensity, in addition to correlated color temperature of specific LED luminaires.
 - .8 System shall be able to provide control of network luminaire intensity, in addition to dynamic features, such as grayscale and color accent of specific LED luminaires.
 - .9 System shall provide correlated color temperature control of specific luminaires over a digital connection.
 - .1 Correlated color temperature shall be controllable through various ranges, such as 3000-5000K and 2700-6500K, with at least 100 steps within the range.
 - .2 Changes in correlated color temperature level shall be controllable through the following:
 - .a Through manual wall switch “raise” and “lower” control
 - .b Through scene-based wall switch control
 - .c Through touch-screen slider or scene-based control
 - .d Through scheduled time-of-day or astronomical events
 - .e Through manually triggered inputs (e.g. dry contact)

- .3 Scheduled, scene, and manually triggered correlated color temperature changes shall be capable of changing over an adjustable fade period of 1 second to 5 minutes.
- .4 Matching wall switch aesthetics shall be available for switches controlling correlated color temperature and static white luminaires.
- .10 System shall allow adjustable high end trim levels for luminaires to allow for higher light levels in the morning to support circadian entrainment levels and lower light levels later in the day.
- .11 Luminaire shall include a low voltage, DC driver with onboard intelligence.
 - .1 Driver shall be programmable.
 - .2 Driver shall optionally provide auxiliary power for embedded devices.
- .10 Wired Distributed Low-Voltage Luminaires
 - .1 Shall be powered and controlled by low voltage wiring.
 - .2 Shall be able to maintain constant lumen output over the specified life of the LED luminaire by automatically varying the dimming control signal to account for lumen depreciation.
 - .3 Shall allow for control of luminaire intensity and, where applicable, dynamic color accent features of specific LED luminaires.
 - .4 Shall be individually addressable, linear fixtures, which may include on-board occupancy and photocell sensors.
 - .5 Shall support onboard occupancy sensor technology that includes:
 - .a Passive Infrared only or Dual Tech acoustic passive.
 - .b A passive infrared occupancy sensor detection methodology or a combination of passive infrared and Passive Dual Technology occupancy sensor detection methodologies shall be available.
 - .c Ultrasonic or Microwave based sensing technologies shall not be accepted.
 - .d Occupancy sensor detection shall be suitable for 7.5' to 15' mounting heights.
 - .e Where applicable, photocell capability shall optionally be included with occupancy sensors. Additional device installation shall not be required for photocell capability.
- .11 Wired Networked Relay and Dimming Panel
 - .1 Product Series: ARP
 - .2 Relay and dimming panel shall be available with 4, 8, 12, 16, 24, 32, 40 or 48 individual relays per panel, with an equal number of individual 0-10V dimming outputs.

- .3 Optional Field Configurable Relays (FCR) used shall have the following required properties:
 - .1 Configurable in the field to operate with single-, double-, or triple-pole relay groupings.
 - .2 Configurable in the field to operate with normally closed or normally open behavior.
 - .3 Provides visual status of current state and manual override control of each relay.
 - .4 Listed for the following minimum ratings:
 - .a 40A @ 120-480VAC Ballast
 - .b 16A @ 120-277VAC Electronic
 - .c 20A @ 120-277VAC Tungsten
 - .d 20A @ 48VDC Resistive
 - .e 2HP @ 120VAC
 - .f 3HP @ 240-277VAC
 - .g 65kA SCCR @ 480VAC
- .4 0-10 dimming outputs shall support a minimum of 100mA sink current per output.
- .5 Relay and dimming outputs shall be individually programmable to support all standard sequence of operations as defined in this specification.
- .6 Panel shall be UL924 listed for control of emergency lighting circuits.
- .7 Panel shall power itself from an integrated 120-277 VAC or optional 347VAC supply.
- .8 Panel shall provide a configurable low-voltage sensor input with the following properties:
 - .1 Configurable to support any of the following input types:
 - .a Indoor Photocell
 - .b Outdoor Photocell
 - .c Occupancy Sensor
 - .d Contact Closure
 - .2 Low voltage sensor input shall provide +24VDC power for the sensor so that additional auxiliary power supplies are not required.
 - .3 Sensor input supports all standard sequence of operations as defined in this specification.
- .9 Panel may include a Digital Time Clock for local schedule control.

- .10 Panel shall provide a contact closure input for each group of 8-relays that acts as a panel override to activate the normally configured state of all relays (i.e., normally open or normally closed) in the panel. This input is intended to provide an interface to alarm systems, fire panels, or BMS system to override the panel.
- .11 Panel shall supply current limited low voltage power to other networked devices connected via low voltage network cable.
- .12 Panel shall be available with NEMA 1 rated enclosure with the following mounting and cover options:
 - .1 Surface-mounted for all panel sizes
 - .2 Flush-mounted for up to 16 relay panel sizes
 - .3 Screw-fastened for up to 16 relay panel sizes
 - .4 Hinged cover with keyed lock for all panel sizes
- .13 Surface-mounted screw cover options for 8 and 16 relay panel sizes shall be plenum rated
- .14 Panel shall be rated from 0-50C for 8 and 16 enclosure sizes, and 0-45C for 32 and 48 enclosure sizes.
- .12 Wired Networked Bluetooth® Low Energy Programming Device
 - .1 Product Series: nIO BT
 - .2 Device shall be plenum rated and be inline wired, screw mountable.
 - .3 Communication and low voltage power shall be delivered to device via standard low voltage network cabling with RJ-45 connectors.
 - .4 Bluetooth Low Energy connection shall allow connection from smartphone application for programming device settings within the local daisy-chain zone (*see list of available settings in section 2.4-System Software Interfaces, Sub-section E*).
 - .5 Device shall provide visual indication of remote Bluetooth connection via LED integrated into device enclosure such that it is visible from all angles while the zone is being programmed.
- .13 Wired Networked Communication Bridge
 - .1 Product Series: nBRG
 - .2 Device shall surface mount to a standard 4" x 4" square junction box.
 - .3 Device shall have 8 RJ-45 ports for connection to lighting control zones (up to 128 devices per port), additional network bridges, and System Controller.
 - .4 Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to System Controller.

- .5 Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply, or powered via low voltage network connections from powered lighting control devices (e.g. power packs).
 - .6 Wired Bridge shall be capable of redistributing power from its local supply and connected lighting control zones with excess power to lighting control zones with insufficient local power. This architecture also enables loss of power to a particular area to be less impactful on network lighting control system.
- .14 Control Modules for Low-Voltage Fixtures:
- .1 Shall be powered by 120 or 277 VAC and be UL2043 listed.
 - .2 Shall be remotely configurable using networked lighting control software.
 - .3 Shall be able to provide UL924-compliant control without the need of an additional, externally-mounted device.

2.7 Wireless Networked Devices

- .1 Wireless Networked Wall Switches, Dimmers
- .1 Products: rPODB, rPODB xS, rPODL, rPODL xS
 - .2 Devices shall recess into single-gang switch box and fit a standard GFI opening.
 - .3 Communication shall be provided by wireless BLE connection and 900MHz link to other devices.
 - .4 Devices shall have options to be powered by battery or line voltage. If powered by battery, expected battery life shall be no less than 10 years.
 - .5 Devices with mechanical push-buttons shall provide tactile and LED user feedback during button press.
 - .6 Devices with mechanical push-buttons shall be made available with custom button labeling.
 - .7 Wall switches & dimmers shall support the following device options:
 - .1 Number of control zones: 1, 2
 - .2 Control Types Supported: On/Off or On/Off/Dimming
 - .3 Colors: Ivory, White, Light Almond, Gray, Red
 - .8 Scene switches shall support the following device options:
 - .1 Number of Scenes. 2, 4
 - .2 Control types supported
 - .a On/Off
 - .b On/Off/Dimming

.c Preset Level Scene Type

- .2 Wireless Networked Auxiliary Fixture Control Devices
 - .1 Products: rIO
 - .2 Communication shall be provided by wireless BLE connection and 900MHz link to other devices.
 - .3 Power shall be delivered to each device via standard low voltage wiring from LED driver.
- .3 Wireless Networked Indoor Combination Occupancy and Photosensors
 - .1 Products: rCMS, rCMS PDT, rLSXR, rSBOR, rCMSB
 - .2 Communication shall be provided by wireless BLE connection and 900MHz link to other devices.
 - .3 Occupancy sensors shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
 - .4 Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state, thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.
 - .5 For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional “dual” technology shall be used.
 - .6 Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.
 - .7 All sensing technologies shall be acoustically passive, meaning they do not transmit sound waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonic technology. Ultrasonic or Microwave based sensing technologies shall not be accepted. Power shall be delivered to each device via standard low voltage wiring from a local power pack, by battery, or by line voltage for devices with available nipple mount.
 - .8 Sensor programming parameter shall be available and configurable remotely from the software
 - .9 Network system shall have ceiling and fixture mounted sensors available, with multiple lens options available customized for specific applications.
 - .10 Sensors shall be available with zero or one integrated dry contact switching relays, capable of switching 1 amp at 24 VAC/VDC (resistive only).

- .11 Sensors shall have standard daylight photosensor for programmable daylight harvesting
 - .12 Photosensor shall provide foot-candle setpoint and a deadband to prevent the artificial light from cycling. Set-point and deadband shall be capable of automatically calibrating through an “Automatic Set-Point Programming” procedure. Min and max dim settings as well as set-point may be manually entered.
 - .13 Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
 - .14 Nipple mounted devices shall include an option for power interruption detection, where unit powers and controls the emergency circuit, and an interruption of power to this circuit for >30 ms forces unit to shunt closed, go to full bright, and ignore all system commands for 90 minutes.
 - .15 Nipple mounted sensors shall have the option to monitor output current. Measurements shall be accurate within 3% of actual when measuring loads whose current is 225mA or greater.
- .4 Wireless Networked Outdoor Combination Occupancy and Photosensors
- .1 Products: rSDGR, rSBOR, rMSOD, rSBG
 - .2 Communication shall be provided by wireless BLE connection and 900MHz link to other devices.
 - .3 Sensor shall be available in both nipple mount and in-fixture mount options.
 - 1. Nipple mount sensor shall have an ingress protection rating of IP66..
 - 2. In-fixture mount sensor shall have an ingress protection rating of IP65..
 - .5 Sensor shall be capable of operating in -40 to 65C ambient temperature ranges
 - .6 Sensors shall be capable of accepting 120-277, 347, or 480VAC input or DC power for embedded device.
 - .7 Occupancy sensors shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
 - .8 Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state, thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.
 - .9 All sensors shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential issue.
 - .10 Sensor programming parameter shall be available and configurable remotely from the software.

- .11 Nipple mounted sensors shall be available with multiple lens options available for various mounting heights.
 - .12 Nipple mounted sensors shall have the option to monitor output current. Measurements shall be accurate within 3% of actual when measuring loads whose current is 225mA or greater.
 - .13 Occupancy sensors shall have standard daylight photosensor for programmable daylight harvesting.
 - .14 Photosensor shall provide foot-candle setpoint and a deadband to prevent the artificial light from cycling. Set-point and deadband shall be capable of automatically calibrating through an “Automatic Set-Point Programming” procedure. Min and max dim settings as well as set-point may be manually entered.
 - .15 Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., changes in car type and color, lamp outages).
 - .16 Devices shall include option for power interruption detection, where unit powers and controls the emergency circuit, and an interruption of power to this circuit for >30 ms forces unit to shunt closed, go to full bright, and ignore all system commands for 90 minutes.
- .5 Wireless Networked Outdoor Twist-to-Lock Photosensors
- .1 Products: rTLN
 - .2 Shall be available with locking type photocontrol as per ANSI C136.10, C136.41.
 - .3 Shall have a rated line voltage of 120-277VAC or 347/480VAC.
 - .4 Shall have a maximum load rating of at least 1800VA / 1000W.
 - .5 Photocontrol shall have an ingress protection rating of IP66.
 - .6 Photocontrol shall support 0-10V or DALI dimming interface.
 - .7 Photocontrol shall accept motion sensor input on pins 6 and 7 to be used for individual or group response to sensor input.
 - .8 Photocontrol shall have an energy measurement accuracy within 2% of actual.
 - .9 Shall operate in -40 degrees to 70 degrees Celsius ambient temperatures.
- .6 Wireless Networked Indoor Embedded Sensors
- .1 Products: rES7, rES7 PDT, rMSOD
 - .2 Communication shall be provided by wireless BLE connection and 900MHz link to other devices.

- .3 Network system shall have embedded sensors consisting of occupancy sensors and/or dimming photocells that can be embedded into luminaire such that only the lens shows on luminaire face.
- .4 Occupancy sensor detection pattern shall be suitable for 7.5' to 40' mounting heights.
- .5 Embedded sensors shall support the following configuration options:
 1. Occupancy Sensing technology: PIR only or Dual Tech acoustic
 2. Daylight Sensing Option: Occupancy only, Daylight only, or combination Occupancy/Daylight sensor
- .6 Devices shall be available with options for both integrated and remote capable antennas such that devices can be optionally installed in a sealed container without detriment to wireless strength.
- .7 Wireless Networked Power Packs
 - .1 Products: rPP20, rPP20 ER, rPP20 EM
 - .2 Communication shall be provided by wireless BLE connection and 900MHz link to other devices.
 - .3 Power Packs shall incorporate one optional Class 1 relay, optional 0-10 VDC dimming output
 - .4 Power Packs shall accept 120 through 277 VAC and carry a plenum rating.
 - .5 Power Packs shall be available with optional 24VDC, 100mA output for use with ceiling mount sensors or other DC powered products.
 - .6 Power Packs shall be available with options for integrated and remote capable antennas such that devices can be optionally installed in a sealed container without detriment to wireless strength.
 - .7 Power Pack programming parameters shall be available and configurable remotely from the software.
 - .8 Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast/driver channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
 - .9 When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
 - .10 Power Packs shall be available with the following options:

- .1 Power Pack capable of full 20-Amp switching of all normal power lighting load types, with optional 0-10V dimming output capable of up to 100mA of sink current.
- .2 Power Packs capable of full 20-Amp switching of general purpose receptacle (plug-load) control.
- .3 Power Packs with UL924 listing capable of full 20-Amp switching of all emergency power lighting load types, with optional 0-10V dimming output capable of up to 100mA of sink current. There shall be two methods of achieving the UL924 operation:
 - .a Power sense of normal power feed, where unit powers and controls emergency circuit, and loss of the normal power sense circuit forces the power pack to shunt closed, go to full bright, and ignore all system commands until normal power is restored.
 - .b Power interruption detection, where unit powers and controls the emergency circuit, and an interruption of power to this circuit for >30 ms forces unit to shunt closed, go to full bright, and ignore all system commands for 90 minutes.
- .4 Power Packs shall have the option of mounting inside a sealed metal enclosure, with a plenum rated antenna protruding from said enclosure to allow for an IP 67 rated application.
- .5 Power Packs shall have the option to monitor output current.
 - .a Measurements for 120-277VAC models shall be within 3% of actual when measuring 425mA or greater of load current.
 - .b Measurements for 120-480VAC models shall be within 3% of actual when measuring 625mA or greater of load current.
- .8 Wireless Networked Luminaires
 - .1 Networked luminaires shall have a mechanically integrated control device.
 - .2 Communication with other devices shall be provided by wireless BLE connection and 900MHz link.
 - .3 System shall be able to turn on/off specific LED luminaires without using a relay, if LED driver supports "sleep mode."
 - .4 System shall be able to provide control of network luminaire intensity
- .9 Wireless Networked Communication Adapter
 - .1 A communication adapter shall be provided that interfaces with the System Controller via USB connection and interfaces with wireless networked devices via 900MHz.
 - .2 Device shall be capable of communicating with at least 750 wireless networked devices and luminaires

- .3 Device shall be supplied with mounting hardware suitable for vertical ceiling mounting or for vertical mounting from a wall.
- .4 Device shall be unresponsive to wired and wireless communications that do not conform to the specific protocols used by the networked lighting control system.
- .5 Device shall be IP66 rated and shall be optionally installed in an indoor or outdoor location.
- .6 Device shall allow programming and control of indoor, outdoor, and industrial wireless control devices through a single user interface.

PART 3 - EXECUTION

3.1 Installation Requirements

.1 Installation Procedures and Verification

- .1 The successful bidder shall review all required installation and pre-startup procedures with the manufacturer's representative through pre-construction meetings.
- .2 The successful bidder shall install and connect the networked lighting control system components according to the manufacturer's installation instructions, wiring diagrams, the project submittals and plans specifications.
- .3 The successful bidder shall be responsible for testing of all low voltage network cable included in the bid. Bidder is responsible for verification of the following minimum parameters:
 - .1 Wire Map (continuity, pin termination, shorts and open connections, etc.)
 - .2 Length
 - .3 Insertion Loss

.2 Coordination with Owner's IT Network Infrastructure

- .1 The successful bidder is required to coordinate with the owner's representative to secure all required network connections to the owner's IT network infrastructure.
 - .1 The bidder shall provide to the owner's representative all network infrastructure requirements of the networked lighting control system.
 - .2 The bidder shall provide to the manufacturer's representative all necessary contacts pertaining to the owner's IT infrastructure, to ensure that the system is properly connected and started up.

.3 Documentation and Deliverables

- .1 The installing contractor shall be responsible for documenting installed location of all networked devices, including networked luminaires. This includes responsibility to provide as-built plan drawing showing device address barcodes corresponding to locations of installed equipment.

- .2 The installing contractor is also responsible for the following additional documentation to the manufacturer's representative if visualization / graphical floorplan software is provided as part of bid package:
 1. As-Built floor plan drawings showing device address locations required above. All documentation shall remain legible when reproducing\scanning drawing files for electronic submission.
 2. As-Built electrical lighting drawings (reflected ceiling plan) in PDF and CAD format. Architectural floor plans shall be based on as-built conditions.
 - .a CAD files shall have layers already turned on/off as desired to be shown in the graphical floorplan background images. The following CAD elements are recommended to be hidden to produce an ideal background graphical image:
 - Titleblock
 - Text- Inclusive of room names and numbers, fixture tags and drawings notes
 - Fixture wiring and homeruns
 - Control devices
 - Hatching or poché of light fixtures or architectural elements
 - .b CAD files shall be of AutoCAD 2013 or earlier. Revit file overall floor plan views shall be exported to AutoCAD 2013.

3.2 System Startup

- .1 Upon completion of installation by the installer, including completion of all required verification and documentation required by the manufacturer, the system shall be started up and programmed.
 - .1 For CAT5 wired devices, low voltage network cable testing shall be performed prior to system startup.
- .2 System start-up and programming shall include:
 - .1 Verifying operational communication to all system devices.
 - .2 Programming the network devices into functional control zones to meet the required sequence of operation.
 - .3 Programming and verifying all sequence of operations.
- .3 Manufacturer shall be capable of on-site or remote startup and programming.

3.3 Project Turnover

- .1 System Documentation
 - .1 Submit software database file with desired device labels and notes completed. Changes to this file will not be made by the factory.
 - .2 Installing contractor to grant access to the owner for the programming database, if requested.

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.2 Owner Training

- .1 Provisions for onsite training for owner and designated attendees to be included in submittal package.

END OF SECTION

SECTION 262100
LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical service requirements.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Materials and installation requirements for cast-in- place concrete equipment pads.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 262300 - Low-Voltage Switchgear: Service entrance equipment.
 - 1. Includes utility metering transformer compartment.
 - 2. Includes non-utility electrical metering.
- F. Section 262413 - Switchboards: Service entrance equipment.
 - 1. Includes utility metering transformer compartment.
- G. Section 262416 - Panelboards: Service entrance equipment.
- H. Section 262713 - Electricity Metering: Non-utility electrical metering.
- I. Section 262816.16 - Enclosed Switches: Service entrance equipment.
- J. Section 312316 - Excavation.
- K. Section 312323 - Fill: Bedding and backfilling.

1.03 REFERENCE STANDARDS

- A. IEEE C2 - National Electrical Safety Code 2017.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.
- B. Coordination:
 - 1. Verify the following with Utility Company representative:
 - a. Utility Company requirements, including division of responsibility.
 - b. Exact location and details of utility point of connection.
 - c. Utility easement requirements.
 - d. Utility Company charges associated with providing service.
 - 2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
 - 3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.
- D. Utility Company charges associated with providing permanent service to be paid by Owner.
- E. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.

F. Scheduling:

1. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.

1.06 QUALITY ASSURANCE

A. Comply with the following:

1. IEEE C2 (National Electrical Safety Code).
2. NFPA 70 (National Electrical Code).
3. The requirements of the Utility Company.
4. The requirements of the local authorities having jurisdiction.

PART 2 PRODUCTS

2.01 ELECTRICAL SERVICE REQUIREMENTS

- A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.
- B. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions and Utility Company requirements.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances and required maintenance access.
- D. Provide required trenching and backfilling in accordance with Section 312316 and Section 312323.
- E. Construct cast-in-place concrete pads for utility equipment in accordance with Utility Company requirements and Section 033000.
- F. Provide required protective bollards in accordance with Utility Company requirements.
- G. Provide required support and attachment components in accordance with Section 260529.
- H. Provide grounding and bonding for service entrance equipment in accordance with Section 260526.
- I. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 260553.

3.02 PROTECTION

- A. Protect installed equipment from subsequent construction operations.

END OF SECTION

SECTION 262200
LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General purpose transformers.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 260533.13 - Conduit for Electrical Systems: Flexible conduit connections.
- E. Section 260548 - Vibration and Seismic Controls for Electrical Systems.
 - 1. Includes requirements for the seismic qualification of equipment specified in this section.

1.03 REFERENCE STANDARDS

- A. 10 CFR 431, Subpart K - Energy Efficiency Program for Certain Commercial and Industrial Equipment - Distribution Transformers Current Edition.
- B. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers 2015.
- C. IEEE C57.96 - IEEE Standard Guide for Loading Dry-Type Distribution and Power Transformers 2013.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- E. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers 2015.
- F. NEMA ST 20 - Dry-Type Transformers for General Applications 2014.
- G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 506 - Standard for Specialty Transformers Current Edition, Including All Revisions.
- J. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate the work with placement of supports, anchors, etc. required for mounting.
 - 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Manufacturer's equipment seismic qualification certification.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE; Or Equal: www.geindustrial.com/#sle.
- B. Eaton Corporation; Or Equal: www.eaton.com/#sle.
- C. Siemens Industry, Inc; Or Equal: www.usa.siemens.com/#sle.
- D. Substitutions: See Section 016000 - Product Requirements.

2.02 TRANSFORMERS - GENERAL REQUIREMENTS

- A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.
- B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
 - 1. Altitude: Less than 3,300 feet (1,000 m).
 - 2. Ambient Temperature:
 - a. Greater than 10 kVA: Not exceeding 104 degrees F (40 degrees C).
 - b. Less than 10 kVA: Not exceeding 77 degrees F (25 degrees C).
- C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.
- D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.
- E. Basic Impulse Level: 10 kV.
- F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- G. Isolate core and coil from enclosure using vibration-absorbing mounts.
- H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.03 GENERAL PURPOSE TRANSFORMERS

- A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.
- B. Insulation System and Allowable Average Winding Temperature Rise:
 - 1. Less than 15 kVA: Class 180 degrees C insulation system with 115 degrees C average winding temperature rise.
 - 2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.
- C. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.
- D. Winding Taps:
 - 1. Less than 3 kVA: None.
 - 2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
 - 3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
 - 4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.
- E. Energy Efficiency: Comply with 10 CFR 431, Subpart K.
- F. Sound Levels: Standard sound levels complying with NEMA ST 20
- G. Mounting Provisions:
 - 1. Less than 15 kVA: Suitable for wall mounting.

2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
 3. Larger than 75 kVA: Suitable for floor mounting.
- H. Transformer Enclosure: Comply with NEMA ST 20.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor clean, dry locations: Type 2.
 - b. Outdoor locations: Type 3R.
 2. Construction: Steel.
 - a. Less than 15 kVA: Totally enclosed, non-ventilated.
 - b. 15 kVA and Larger: Ventilated.
 3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
 4. Provide lifting eyes or brackets.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install transformers in accordance with NECA 409 and IEEE C57.94.
- D. Use flexible conduit, under the provisions of Section 260533.13, 2 feet (600 mm) minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.
- F. Install transformers plumb and level.
- G. Transformer Support:
 1. Provide required support and attachment in accordance with Section 260529, where not furnished by transformer manufacturer.
 2. Provide required vibration isolation and/or seismic controls in accordance with Section 260548.
 3. Use integral transformer flanges, accessory brackets furnished by manufacturer, or field-fabricated supports to support wall-mounted transformers.
 4. Unless otherwise indicated, mount floor-mounted transformers on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 033000.
 5. Use trapeze hangers assembled from threaded rods and metal channel (strut) to support suspended transformers. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- H. Provide grounding and bonding in accordance with Section 260526.
- I. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.
- J. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.

3.02 ADJUSTING

- A. Measure primary and secondary voltages and make appropriate tap adjustments.
- B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.03 CLEANING

- A. Clean dirt and debris from transformer components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 262413
SWITCHBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.
- B. Overcurrent protective devices for switchboards.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260529 - Hangers and Supports for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e (Amended 2017).
- B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers 2016.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 400 - Standard for Installing and Maintaining Switchboards 2007.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- F. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.
- G. NEMA PB 2 - Deadfront Distribution Switchboards 2011.
- H. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less 2013.
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- K. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.
- L. UL 891 - Switchboards Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Switchboards - Basis of Design: [_____].
- B. Switchboards - Other Acceptable Manufacturers:
 - 1. Eaton Corporation; Or Equal: www.eaton.com/#sle.
 - 2. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
 - 3. Siemens Industry, Inc: www.usa.siemens.com/#sle.
- C. Substitutions: See Section 016000 - Product Requirements.

2.02 SWITCHBOARDS

- A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.
- D. Service Entrance Switchboards:
 - 1. Listed and labeled as suitable for use as service equipment according to UL 869A.
 - 2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
 - 3. Comply with Utility Company requirements for electrical service.
- E. Service Conditions:
 - 1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
 - a. Altitude: Less than 6,600 feet (2,000 m).
 - b. Ambient Temperature:
 - 1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
 - 2. Provide switchboards and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
- F. Short Circuit Current Rating:
 - 1. Label equipment utilizing series ratings as required by NFPA 70.
- G. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.
- H. Bussing: Sized in accordance with UL 891 temperature rise requirements.
 - 1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
 - 2. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
 - 3. Phase and Neutral Bus Material: Aluminum.
 - 4. Ground Bus Material: Aluminum.
- I. Conductor Terminations: Suitable for use with the conductors to be installed.
 - 1. Line Conductor Terminations:
 - a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - b. Main and Neutral Lug Type: Mechanical.
 - 2. Load Conductor Terminations:
 - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - b. Lug Type:
- J. Enclosures:
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
 - b. Outdoor Locations: Type 3R.
 - 2. Finish: Manufacturer's standard unless otherwise indicated.
 - 3. Enclosure Space Heaters:
 - a. Provide in each switchboard section installed outdoors and in unconditioned indoor spaces.
 - b. Size according to manufacturer's recommendations for worst case ambient temperature to prevent condensation.
 - c. Heater Control: Thermostat.
 - d. Heater Power Source: Provide connection to transformer factory-installed in switchboard or suitable external branch circuit as indicated or as required.

4. Outdoor Enclosures:
 - a. Enclosure Type: Non-walk-in type unless otherwise indicated.
 - b. Color: Manufacturer's standard.
 - c. Access Doors: Lockable, with all locks keyed alike.
- K. Future Provisions:
 1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- L. Instrument Transformers:
 1. Comply with IEEE C57.13.
 2. Select suitable ratio, burden, and accuracy as required for connected devices.
 3. Current Transformers: Connect secondaries to shorting terminal blocks.
 4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.03 OVERCURRENT PROTECTIVE DEVICES

- A. Circuit Breakers:
 1. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 2. Molded Case Circuit Breakers:
 - a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

2.04 SOURCE QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
 1. Dielectric tests.
 2. Mechanical operation tests.
 3. Grounding of instrument transformer cases test.
 4. Electrical operation and control wiring tests, including polarity and sequence tests.
 5. Ground-fault sensing equipment test.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.
- C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.
- D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch (10 mm) between switchboard and wall.
- E. Provide required support and attachment in accordance with Section 260529.
- F. Install switchboards plumb and level.
- G. Unless otherwise indicated, mount switchboards on properly sized 4 inch (100 mm) high concrete pad constructed in accordance with Section 033000.
- H. Provide grounding and bonding in accordance with Section 260526.
- I. Install all field-installed devices, components, and accessories.

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- J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- K. Provide filler plates to cover unused spaces in switchboards.

3.02 CLEANING

- A. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred surfaces to match original factory finish.

3.03 PROTECTION

- A. Protect installed switchboards from subsequent construction operations.

END OF SECTION

SECTION 262416
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Load centers.
- D. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 262813 - Fuses: Fuses for fusible switches and spare fuse cabinets.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NECA 407 - Standard for Installing and Maintaining Panelboards 2015.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- D. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.
- E. NEMA PB 1 - Panelboards 2011.
- F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less 2013.
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- J. UL 67 - Panelboards Current Edition, Including All Revisions.
- K. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Corporation; Or Equal: www.eaton.com/#sle.
- B. Schneider Electric; Square D Products; Or Equal: www.schneider-electric.us/#sle.
- C. Siemens Industry, Inc; Or Equal: www.usa.siemens.com/#sle.
- D. Substitutions: See Section 016000 - Product Requirements.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet (2,000 m).

2. Ambient Temperature:
- C. Short Circuit Current Rating:
 1. Label equipment utilizing series ratings as required by NFPA 70.
- D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

2.03 OVERCURRENT PROTECTIVE DEVICES

- A. Fusible Switches:
 1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
 2. Fuse Clips: As required to accept indicated fuses.
 3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

2.04 SOURCE QUALITY CONTROL

- A. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 260529.
- F. Install panelboards plumb.
- G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.
- H. Provide grounding and bonding in accordance with Section 260526.
- I. Install all field-installed branch devices, components, and accessories.
- J. Provide fuses complying with Section 262813 for fusible switches as indicated.

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- K. Provide filler plates to cover unused spaces in panelboards.

3.02 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 262726
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Wall dimmers.
- C. Fan speed controllers.
- D. Receptacles.

1.02 RELATED REQUIREMENTS

- A. Section 260533.16 - Boxes for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for 2014h, with Amendments (2017).
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification) 2014g, with Amendment (2017).
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
- E. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2020).
- F. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2016.
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 20 - General-Use Snap Switches Current Edition, Including All Revisions.
- I. UL 498 - Attachment Plugs and Receptacles Current Edition, Including All Revisions.
- J. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- K. UL 1310 - Class 2 Power Units Current Edition, Including All Revisions.
- L. UL 1472 - Solid-State Dimming Controls Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide GFCI protection for receptacles installed within 6 feet (1.8 m) of sinks.
- E. Provide GFCI protection for receptacles installed in kitchens.
- F. Provide GFCI protection for receptacles serving electric drinking fountains.

- G. Unless noted otherwise, do not use combination switch/receptacle devices.

2.02 WALL SWITCHES

A. Manufacturers:

1. Hubbell Incorporated; Or Equal: www.hubbell.com/#sle.
2. Leviton Manufacturing Company, Inc; [_____]: www.leviton.com/#sle.
3. Pass & Seymour, a brand of Legrand North America, Inc; Or Equal: www.legrand.us/#sle. 4. [_____].
5. Substitutions: See Section 016000 - Product Requirements.

- B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

2.03 RECEPTACLES

A. Manufacturers:

1. Hubbell Incorporated; Or Equal: www.hubbell.com/#sle.
2. Leviton Manufacturing Company, Inc; Or Equal: www.leviton.com/#sle.
3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com/#sle.
4. Pass & Seymour, a brand of Legrand North America, Inc; Or Equal: www.legrand.us/#sle.
5. Substitutions: See Section 016000 - Product Requirements.
6. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

- B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:

1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
2. Automatically Controlled Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.
3. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFCI Receptacles:

1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
 - a. Provide test and reset buttons of same color as device.

E. USB Charging Devices:

1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.

PART 3 EXECUTION

3.01 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of wiring devices provided under this section.
 - 1. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.
- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- H. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- I. Install wall switches with OFF position down.
- J. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- K. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- L. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect each wiring device for damage and defects.
- C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- D. Test each receptacle to verify operation and proper polarity.
- E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.04 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SURGE PROTECTION FOR LOW VOLTAGE ELECTRICAL POWER CIRCUITS

Square D™ by Schneider Electric
SurgeLogic™ Low Voltage Surge Protection

PART 1 GENERAL

1.1 SUMMARY

- A. Scope: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and installation for surge protection for low voltage electrical power circuits as required for the complete performance of the work, and as shown on the Drawings and as herein specified.
- B. Section Includes: The work specified in this Section includes, but shall not be limited to, the following:
 - 1. Requirements for both field-mounted SPDs (externally mounted), and integrated SPDs (installed from the factory) for low voltage power distribution and control equipment.

1.2 REFERENCES

- A. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.
- B. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - 1. ANSI/IEEE C62.41.1, "Guide on the Surges Environment in Low Voltage (1000 V and Less) AC Power Circuits."
 - 2. ANSI/IEEE C62.41.2, "Recommended Practice on Characterization of Surges in Low Voltage (1000 V and Less) AC Power Circuits."
 - 3. ANSI/IEEE C62.45, "Guide on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits."
- C. International Organization for Standardization (ISO):
 - 1. ISO 9001, "Quality Management Systems - Requirements."
- D. National Fire Protection Association (NFPA):
 - 1. NFPA 70, "National Electrical Code," hereinafter referred to as NEC.

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E. Underwriters Laboratories, Inc. (UL):

1. UL 67, "Standard for Panelboards."
2. UL 96A, "Standard for Installation Requirements for Lightning Protection Systems."
3. UL 845, "Motor Control Centers."
4. UL 857, "Busways."
5. UL 891, "Switchboards."
6. UL 1283, "Standard for Safety for Electromagnetic Interference Filters."
7. UL 1449, "Standard for Surge Protective Devices."
8. UL 1558, "Standard for Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear."

1.3 DEFINITIONS

- A. $I_{(n)}$: Nominal discharge current rating.
- B. MCOV: Maximum continuous operating voltage.
- C. Protection Modes: The pair of electrical connections where the VPR applies.
- D. MOV: Metal oxide varistor; an electronic component with a significant non-ohmic current voltage characteristic.
- E. OCPD: Overcurrent protective device.
- F. SCCR: Short circuit current rating.
- G. SPD: Surge protective device.
- H. VPR: Voltage protection rating.

1.4 SYSTEM DESCRIPTION

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A. General SPD Requirements:

1. SPD with accessories shall be listed and labeled as defined in NEC, by UL, and marked for intended location and application.
2. Comply with UL 1449.
3. Comply with UL 1283 (applies to Type 2 SPDs).
4. Design in accordance with ANSI/IEEE C62.41.1, ANSI/IEEE C62.41.2, and ANSI/IEEE C62.45.
5. SPDs manufacturer shall be ISO 9001 certified.
6. MCOV of the SPD shall not be less than 115 percent for 480Y/277V and 125 percent for 208Y/120V nominal RMS system voltages.
7. SPDs installed internal to the distribution equipment shall be of the same manufacturer as the equipment. The equipment shall be fully tested and certified to the following UL standards:
 - a. Panelboards: UL 67.
 - b. Motor Control Centers: UL 845.
 - c. Busway: UL 857.
 - d. Switchboards: UL 891.
 - e. Switchgear: UL 1558.

1.5 SUBMITTALS

- A. General: See [Section 01 33 00 - Submittal Procedures] [Section 01300 - Submittals].
- B. Product Data: Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications.
 1. For each type of product indicated include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 2. Provide verification the SPD is listed or recognized through UL to the latest safety standard, UL 1449.
- C. Shop Drawings: Submit shop drawings for each product and accessory required. Include information not fully detailed in manufacturer's standard product data.
- D. Operation and Maintenance Data: Submit operation and maintenance data for surge protection for low voltage electrical power circuits to include in operation and maintenance manuals.

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- E. Warranty Data: Submit sample of special warranties.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of surge protection for low voltage electrical power circuits of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of five years.
2. Installer Qualifications: Installer shall be a firm that shall have a minimum of five years of successful installation experience with projects utilizing surge protection for low voltage electrical power circuits similar in type and scope to that required for this Project and shall be approved by the manufacturer.

- B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.

- C. Single Source Responsibility: Obtain surge protection for low voltage electrical power circuits and required accessories from a single source with resources to produce products of consistent quality in appearance and physical properties without delaying the work. Any materials which are not produced by the manufacturer shall be acceptable to and approved by the manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and lot number, if any.

- B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.8 WARRANTY

- A. General: See [Section 01 77 00 - Closeout Procedures] [Section 01770 - Closeout Procedures].

- B. Special Warranty: Submit a written warranty executed by the manufacturer, the Installer, and the Contractor, agreeing to repair or replace surge protection for low voltage electrical power circuits that fail in materials or workmanship within the specified warranty period.

1. Warranty Period: Warranty period shall be 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Product specified is "Surgeologic Surge Protection" as manufactured by Square D by Schneider Electric. Items specified are to establish a standard of quality for design, function, materials, and appearance. Equivalent products by other manufacturers are acceptable. The Architect/Engineer will be the sole judge of the basis of what is equivalent.

2.2 SERVICE ENTRANCE SUPPRESSORS

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A. SPDs: Comply with UL 1449.

1. SPDs installed on the line side of the service entrance OCPD shall be Type 1 SPDs. SPDs installed on the load side of the service entrance OCPD shall be either Type 1 or Type 2 SPDs.
2. Type 2 SPDs shall also comply with UL 1283.

B. Features and Accessories: SPDs shall provide the following features and accessories:

1. Internal fusing design capable of disconnecting the SPD before any damaging external effects to the suppressor or surroundings occur.
2. Indicator light(s) display for power and protection status with push-to-test capabilities.
3. Audible alarm with silencing switch.
4. Form C contacts; one normally open and one normally closed for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
5. Surge counter with reset switch.
6. Optional integral disconnect switch for externally mounted SPDs. SPDs integrated into factory supplied equipment shall have an input disconnect switch or circuit breaker unless indicated on the equipment drawings/data sheets.

C. Surge Current Rating: The surge current rating of the SPD shall be dependent of its category/location, as follows:

Category/Location	Application	Per Phase	Per Mode
C	Service Entrance	240 kA	120 kA
B	Distribution	160 kA	80 kA

D. Protection Modes:

1. UL 1449 VPR for grounded WYE configured circuits shall not exceed the following:

Modes	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	800 volts	1200 volts	1500 volts
L-L	1200 volts	2000 volts	2500 volts

2. UL 1449 VPR for Delta configured circuits shall not exceed the following:

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Modes	240D	480D	600D
L-G; N-G	1200 volts	2000 volts	2500 volts

- E. SCCR: Per NEC 285.6, the short circuit current rating of the SPD shall be equal to or greater than the available short circuit current at the point on the system where installed.
- F. Nominal Discharge Current Rating: 20 kA $I_{(n)}$.
 - 1. Surge protective devices located at service entrance locations shall carry a minimum nominal discharge current rating of 20 kA to meet the requirements of UL 96A.

2.3 DISTRIBUTION/ BRANCH PANEL SUPPRESSORS

- A. SPDs: Comply with UL 1449.
 - 1. Type 1 or Type 2 SPDs.
 - 2. Type 2 SPDs shall also comply with UL 1283.
- B. Features and Accessories: SPDs shall provide the following features and accessories:
 - 1. Internal fusing design capable of disconnecting the SPD before any damaging external effects to the suppressor or surroundings occur.
 - 2. Indicator light(s) display for power and protection status.
 - 3. Audible alarm with silencing switch.
 - 4. Form C contacts; one normally open and one normally closed for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 - 5. Surge counter with reset switch.
 - 6. Optional integral disconnect switch for externally mounted SPDs. SPDs integrated into factory supplied equipment shall have an input disconnect switch or circuit breaker unless indicated on the equipment drawings/data sheets.
- C. Surge Current Rating: The surge current rating of the SPD shall be dependent of its category/location, as follows:

Category/Location	Application	Per Phase	Per Mode
B	Distribution	160 kA	80 kA
B	Branch	120 kA	60 kA

- D. Protection Modes:

1. UL 1449 VPR for grounded WYE configured circuits shall not exceed the following:

Modes	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	800 volts	1200 volts	1500 volts
L-L	1200 volts	2000 volts	2500 volts

2. UL 1449 VPR for Delta configured circuits shall not exceed the following:

Modes	240D	480D	600D
L-G; N-G	1200 volts	2000 volts	2500 volts

- E. SCCR: Per NEC 285.6, the short circuit current rating of the SPD shall be equal to or greater than the available short circuit current at the point on the system where installed.
- F. Nominal Discharge Current Rating: 10 kA $I_{(n)}$.

2.4 ENCLOSURES

- A. Enclosure shall meet or exceed the ratings for the environment to be installed as indicated on drawings.
 1. Indoor Enclosures for Externally Mounted SPDs: NEMA 250, Type 3R.
 2. Outdoor Enclosures for Externally Mounted SPDs: NEMA 250, Type 3R, 4X.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Architect, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
 1. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

3.2 INSTALLATION

- A. Install surge protection for low voltage electrical power circuits in accordance with reviewed product data, final shop drawings, manufacturer's written instructions and recommendations, and as indicated on the Drawings.
- B. Install SPD devices at the service entrance in accordance with NEC. SPDs installed on the line side of the service entrance OCPD shall be Type 1 SPDs. SPDs installed on the load side of the OCPD shall be either Type 1 or Type 2 SPDs.

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- C. Follow manufacturer's recommended installation practices.
 - 1. Provide a minimum 30 ampere circuit breaker as a dedicated disconnecting means for the SPD unless otherwise indicated.
 - 2. Install SPDs with properly rated conductors between suppressor and points of attachment as short and straight as possible; adjust circuit breaker positions to achieve shortest and straightest leads.
 - 3. Do not splice and extend SPD leads unless specifically permitted by manufacturer.
 - 4. Twist input conductors together to reduce the input inductance.

3.3 FIELD QUALITY CONTROL

- A. See [Section 01 45 23 - Inspecting and Testing Services] [Section 01410 - Inspecting and Testing Services].
- B. Perform the following tests and inspections.
 - 1. Compare equipment nameplate data for compliance with the Drawings and the Specifications.
 - 2. Inspect anchorage, alignment, grounding, and clearances.
 - 3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- C. A SPD will be considered defective if it does not pass inspections.
- D. Prepare inspection reports.

3.4 DEMONSTRATION

- A. Start-Up Service:
 - 1. Complete start-up checks according to manufacturer's written instructions.
 - 2. Do not perform insulation resistance tests of the distribution wiring equipment with SPDs installed. Disconnect all wires, including, but not limited to, neutral of the SPD before conducting insulation resistance tests, and reconnect them immediately after the testing is over.
 - 3. Energize SPDs after power system has been energized, stabilized, and tested.

3.5 PROTECTION

- A. Provide final protection and maintain conditions in a manner acceptable to the Installer, that shall ensure that the surge protection for low voltage electrical power circuits shall be without damage at time of Substantial Completion.

END OF SECTION

SECTION 27 41 00 - AUDIO-VIDEO SYSTEMS

PART 1 - GENERAL

1.01 Scope

- A. This section describes the products and execution requirements relating to furnishing and installation of Audio-Video Systems for the project.

1.02 RELATED WORK

APPLICABLE PROVISIONS OF DIVISION 01 GOVERN WORK UNDER THIS SECTION.

Section 26 05 26 – grounding and bonding for electrical systems

Section 26 05 29 – hangers and supports for electrical systems

Section 26 05 33 – raceway and boxes for electrical systems

Section 27 10 13 – structured cabling

Coordinate with division 26 on raceway/junction box locations for audio visual equipment and routing of audio, video, control, and power cables/raceway from equipment, terminal and pull boxes to system equipment racks.

1.03 DEFINITIONS

The following shall serve as general identifiers and govern the specified herein.

Owner/agency – city of hermosa beach

Architect – project architect sometimes referred to as the lead architect/engineer (a/e).

Ae, engineer or consultant – company or individual responsible for audio-video system design.

Contractor – see av system installer.

Av/it – abbreviation for “audio-video /information technology”.

Avixa – “avixa” the trade association representing the professional audio-video and information communication industries worldwide. Previously known as infocomm.

Av systems – “audio visual systems” include all equipment necessary to fulfil the intent of sharing, communicating, recording, audio/video sources to classrooms, conference rooms, large gathering rooms in person or virtually.

Av systems room – an enclosed area or room specifically designated for locating equipment racks for the av system equipment that include routing, monitoring, termination, and/or cross connecting of

audio-visual system cable (i.e., riser cable) to other audio-visual system cable, and/or equipment and racks.

Av system installer – the electrical contractor’s business unit or sub-contractor responsible for work covered by this section and related drawings.

Av control system programmer – the programmer that develops the control code and touch panel user interface to operate the av system.

Byod – “bring your own device”. This refers to users bringing their own device as a source for av systems.

Cec – abbreviation for “consumer electronics control”, an hdmi feature designed for the user to command and control cec enabled devices – e.g., displays, dvd, others – that are connected through hdmi connectors.

Cis - abbreviation for “common intelligibility scale” used to provide a scale for a room intelligibility response.

Cts – “certified technology specialist” the av basic level of tested certification offered by avixa.

Cts-i – “certified technology specialist - installer” the av installation level of tested certification offered by avixa.

Cts-d – “certified technology specialist - designer” the av designer level of tested certification offered by avixa.

Dsp – “digital signal processor”, a microprocessor-based system to take input signals like microphones, audio video sources, phone lines, and process them with built-in audio tools. Route them to outputs for use in multiple destinations in the av system architecture.

Hdmi – abbreviation for “high-definition multimedia interface”, a proprietary audio-video interface for transmitting uncompressed video data and compressed signals from an hdmi compliant source to an hdmi compliant display including projectors. Hdmi implements the eia/cea-861 standards.

Hvac – “heating ventilation and air conditioning”. Division 23 contractor responsibility.

Nic – the terms “nic” and “not in contract” are equivalent to “provided by others.” The contractor is responsible for providing cabling, plates, installation materials, and other infrastructure as indicated on drawings and herein to provide ready installation of nic equipment.

Ofici - the term “ofci” is defined as “owner furnished contractor installed” shall refer to equipment that will be furnished by the owner or agency for installation by the contractor.

Ofoi – the term “ofoi” is defined as “owner furnished owner installed” to indicate the av, computer equipment that will be furnished and installed by owner or agency.

Sti – abbreviation for “speech transmission index” to measure speech intelligibility in a room or theater.

Telecom/data installer – the electrical contractor’s business unit or sub-contractor responsible for division 27 work that does not include the av systems as described in specification 27 41 00.

1.04 REFERENCES

- A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association.
- B. All materials shall be listed by UL and shall bear the UL label. If UL has no published standards for a particular item, then other national independent testing standards shall apply, and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.
- C. Other applicable standards (plus applicable update bulletins and errata) are as follows:
 - 1. General
 - a. ANSI/IEEE C2 - National Electrical Safety Code
 - b. SPS Chapter 316 – Wisconsin Dept. of Safety and Professional Services Electrical Code
 - 2. AV-Specific
 - a. Avixa Audio Coverage Uniformity in Listener Areas - A102.01:2017
 - b. Avixa Cable Separation Guidelines - F502.01:2018
 - 3. Structured Cabling and Infrastructure
 - a. Refer to specification Section 27 10 00.

1.05 SCOPE OF WORK

- A. General
 - 1. Provide all materials, labor, drawings, in the design for a complete and fully operational AV system as described herein and on related drawings.
 - 2. Provide all connectors, hardware, transformers, power supplies, rack panels, interfaces, fasteners, wire harnessing materials, bushings and any other incidentals required for complete and proper functioning of this system whether specifically listed or not.
- B. Coordination
 - 1. Coordinate with the City, AE, Architect, and other trades to comply with all requirements as defined by the Plans and Specifications.
 - 2. Coordinate with Division 26 as applicable to include AV-specific power and grounding and bonding.

3. Coordinate with Division 27 Telecom/Data installer as applicable to include AV-specific Telecom/Data devices.
4. Coordinate with the Architect and Agency on final color selection and/or the painting of any exposed loudspeakers and any/all exposed system components to match the room's aesthetics and finishes.

C. Installation

1. Installation work shall not begin on the project installation without approved Shop Drawings.
2. Follow manufacturer's recommendations as specified for cabling and equipment system installation.
3. Furnish and install cable management hardware as required including areas internal to rack cabinets, areas between pieces of equipment not housed in rack cabinets, and areas that extend cabling from rack cabinets and equipment to the greater facility cabling infrastructure.
4. Furnish and manage all lifts, ladders, scaffolding or other resources as needed for safe installation. Coordinating with other trades as needed.
5. Ensure that all equipment, except for portable equipment, are firmly fastened or attached in place.
6. A safety factor of at least five shall be utilized for all brackets, fasteners, and attachments.
7. Furnish and install all video projector mounts, including support assemblies back to structural members. The AV System Installer shall pay close attention to obstructions which vary from room to room. Provide safety retention cables for overhead equipment such as loudspeakers, projectors, etc.
8. Field verify all projector locations.
9. Resolve any obstruction conflicts for optimal performance with the AE consultant and Architect. Confirm projector lens selection prior to construction.
10. Mount and align the projectors so that digital keystone correction is not required. Optical lens shift may be used if necessary to align the image with the screen image area. If possible, mount projectors perpendicular to the screen surface. The image quality shall provide a focus on the content by reducing any image distortion from poor geometry due to projector mounting.
11. Ensure that all equipment mounting styles and locations comply with the 2010 ADA Standards for Accessible Design.
12. Furnish AV-specific boxes as noted on the AV drawings for installation by Division 26.

1.06 AV SYSTEM DESIGN

- A. General
 - 1. Digital audio systems as the design requires for mixing analog audio signals and digital audio signals. Coordinate any RF based audio systems with Agency for operating frequencies already in use on campus.
 - 2. Provide a control system design that will operate as the design requires include feedback from the Agency on operational concerns.
- B. AV System Programming
 - 1. Provide an operational AV System Control program designed and programmed with the submittals as specified in the Project Drawings.
 - 2. Provide Develop, install, and debug all custom control programming code as required and/or as specified.
 - 3. Provide to the Owner uncompiled programming control code as specified and audio DSP operating code.
 - 4. Provide low voltage control system interfaces (serial, IP, relay dry contact) to facilitate operation of lighting and/or shades where specified.
- C. Testing
 - 1. Test and adjust AV systems and components for optimal performance.
 - 2. Provide test data measurements that are included with test equipment used in testing system performance.
 - 3. Provide initial date of test and measurement verification reports to the AV Consultant as specified.
 - 4. Verify that all individual AV system components operate within the complete AV system as intended by the approved AV system design documents and specifications.

1.07 PROJECT MANAGEMENT

- A. Oversee and coordinate all activities for the successful completion of the Project.
- B. Provide to the AOR, as a part of the prefabrication submittal, the name of the Project Manager that will manage all duties and responsibilities as specified herein, during the term of the project including the name of a backup Project Manager.
- C. Make decisions on behalf of the AV System Installer on a day-to-day basis and shall retain the authority of accepting notices of deduction, inspection reports, payment schedules and any other project related correspondence on behalf of the owner.
- D. Manage schedule and attend project management meetings, during which time all system related issues are discussed, scheduled, confirmed, and/or resolved.
- E. Upon notification by the AOR, of any project related installation issue, or issue that may contradict the specifications as stated herein, the Project Manager shall respond to such issue, verbally and/or in writing within an eight (8) hour period.

- F. Responses to such issues as stated above shall include a clear understanding of the issue, along with a tentative plan of action, reflecting milestones and/or deadlines to resolve the issue.
- G. Where appropriate, based on the overall importance of the project issue, the Project Manager shall follow-up their initial response with a written response to the issue within 24 hours of identification of the issue.
- H. Submit prior to installation a schedule reflecting key milestone of the Project, including but not limited to the following:
 - a. Master Plan submittal
 - b. Prefabrication submittal
 - c. Ordering, delivery, and installation of head-end System equipment
 - d. Field equipment delivery
 - e. Installation schedule including start and end dates and major milestones
 - f. Final System test
 - g. Acceptance of System
 - h. Delivery of Documentation
 - i. Training
- I. Provide updates to the schedule on a weekly basis to reflect the status of each key milestone as the Project progresses.
- J. Provide updates to the above-mentioned items at the request of the Owner, and shall address each item, as it relates to the active status of the Project.

1.08 TYPICAL ROOM/SYSTEM DESCRIPTIONS: QUALITY ASSURANCE

- A. Manufactured Items
 - 1. The manufacturer(s) of cabling and connectivity components shall be a company specializing in and having a minimum of five years documented experience in producing products like those specified in this and related sections.
- B. AV System Installer Qualifications
 - 1. General
 - a. AV System Installer shall:
 - Have expertise in building an AV system of the size and scope described herein and in related drawings.
 - Have successfully completed one or more projects of scope 50% or more of the magnitude specified by these documents.
 - Have the necessary certifications to install products and provide for Guarantees as specified herein.
 - Be a dealer for the past five years for the active equipment provided.
 - Be capable of providing all quality control (QC) and safety inspections as needed throughout installation.
 - Have access-to and experience-with Test Equipment necessary to perform commissioning tasks.
- C. Certifications
 - 1. AV System Installer staff credentials shall include:
 - a. AVIXA Certified Technology Specialist certification with an installation endorsement (CTS-I) in good standing.

- b. AVIXA Certified Technology Specialist certification with a designer endorsement (CTS-D) in good standing for design review.
 - c. Specified Manufacturers' (per Project Drawings) Certified Designer/Programmer.
2. Installation Personnel shall have a AVIXA CTS certification; no more than four (4) CTS certified installers for everyone CTS-I certified installer on-site.
 3. Certifications shall be current and in place at time of Bidding and remain so throughout project.
- D. AV Control System Programmer Certifications and Qualifications:
1. Individuals performing the AV/DSP control programming and setup shall have manufacturer's control system programming training and certification for the specified AV control system designed in the contract documents.
 2. Shall be the dealer of record for the control system specified.
 3. Provide an uncompiled final approved copy of the AV/DSP source code to Agency via agreed method.
 4. Sub-Contractors shall conform to the same certification standards listed above. All AV/DSP control source code shall become the property of the Agency upon completion of the project.

1.09 SUBMITTALS

- A. General:
1. The AV System Installer shall be responsible for verifying the accuracy of the system designs documented in the Scope of Work and related acceptance of responsibility provide in the shop drawings.
 2. Submit general catalog sheets and system design drawings with model numbers highlighted to indicate specific items proposed and proper identification of equipment by name and/or number, as indicated in the design documents.
 3. AE consultant shall provide comments for the Contractor's correction and resubmission. Do not submit hard copies of web pages. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.
 4. Group Submittals to include complete submittals of related systems, products, and accessories in a single submittal.
 5. Mark dimensions and values in units to match those specified.
 6. The drawing submittals shall be non-scanned printed in electronic (Acrobat PDF) format.
 - a. Reproductions of AE Consultant's drawings shall not be acceptable.
 - b. Drawings shall be rendered in AutoCAD. CAD drawings (.dwg format)are required as part of final documentation.
 7. Provide Submittal documents as required to support the construction schedule to be identified at the Pre-Construction Meeting.

8. Submittal documents that are re-submitted for review shall include revision dates that indicate when changes from previous reviews were performed. All revisions made to re-submittal documents must be clouded and all clouds must be identified by the corresponding line-item number on the review roster.
9. A list of changes to re-submittal documents must also be included.

B. Shop drawings

1. Wiring diagrams shall show AV systems wiring and schematic designations and equipment locations on drawings submitted in 30" x 42" format.
2. Provide a full list in Excel spreadsheet form of cable runs including termination locations, numbers/identification, equipment schedule and electrical grounding to AV equipment rack locations and AV headend locations.
3. Floor plan drawings shall be required for raceway, floor boxes, poke throughs and cabling. Drawings shall indicate pull-box locations required in addition to boxes already indicated on the plans.
4. Include in wiring diagram drawings electrically powered equipment that shall remain on (not under system control) and the electrically powered equipment that shall be on/off under system control.
5. Provide conduit riser drawings for AV conduits required for installation of back boxes and ceiling enclosures including the proper grounding inclusion on the schematic drawings.
6. Provide detailed drawings of instructor workstations indicating the locations of AV equipment to be mounted in the workstations (if applicable).
7. Provide detailed elevation drawings of equipment racks providing locations of AV equipment being mounted in these racks and future space openings.
8. Drawings shall include cable layouts, locations for terminal blocks, transformers, relays, and power supplies.
9. Provide Display- and Projection System-specific drawings and calculations.
 - a. Include screen sizes, projector locations, projector throw ranges and field verified measurements to confirm lens selection and viewing angles (plan drawings).
10. Provide remote control touch screen layouts and flowcharts. Provide full size drawing sheet (PDF Format) showing touch panel screen shots organized as a flow chart.
11. Develop and submit As-Built Drawings detailing the installed systems as specified for approval including the room numbers on drawings that reflect Agency room numbers and not Architect room numbers.

- C. During Construction
 - 1. Provide updates to the AV system design that may affect the design drawings as approved. The updates shall include change orders, equipment model updates that are due to model changes by the specified manufacturer.

- D. Mockups
 - 1. Provide on request, mockups of:
 - Floor boxes
 - Poke-through Assemblies
 - AV Backboxes
 - Wall Mounted Touch Panels
 - AV-specific Boxes and Wall Plates
 - Conference Room table-mounted AV input Assembly

 - 2. Provide samples of the AV System furniture finishes to provide selection before ordering to be reviewed and approved by Owner, and Architect.

1.010 WARRANTY

- A. Provide guarantees per Conditions of the Contract.

- B. Manufacturer warranties shall be activated in the Agency's name.

- C. Items not covered include Agency-caused failure, defect or damage including controls re-adjustment, system re-tuning or injury to the system beyond normal wear.

- D. During the warranty period – within 48 hours of original notification – provide emergency service to restore operation of the system, replacing defective materials, repairing faulty workmanship, making temporary repairs, and providing loaner equipment as necessary, all at no charge.

- E. Provide to the Agency before any service call whether such call is or is not covered under warranty. The Agency may be invoiced for non-warranty calls.

- F. Make available after hours or weekend service at a premium rate not to exceed 1.5 times normal hourly rate.

- G. Provide technical support via telephone at no charge during the warranty period.

- H. Maintain engineering and service departments capable of rendering phone support and advice regarding system operations regarding installation and operational adjustment of the systems. This support may result in scheduling a service call to the site to further determine any equipment issues that could not be handled via the phone support.

- I. The equipment listed in “Work by State and/or Agency” that was OFCI shall have warranty provided by AV System Installer for the installation work not the equipment listed.
- J. Prior to the end of the warranty period provide (2) scheduled follow up service and maintenance visits by technically qualified personnel to make AV system updates and adjustments at no additional charge.
- K. Make all tests, adjustments, or replacements in the presence of Agency technician, or other person designated by the Agency Representative. Upon completion of each call provide a report to clearly indicate any replacements or adjustments and any evidence of tampering.
- L. All service calls pertaining to control system (e.g., alteration of buttons, non-responsive commands, etc.) shall fall under the purview of the Control System Programmer.

PART 1 -

PART 2 - PRODUCTS

1.011 EQUIPMENT STANDARDS

- A. Components that comprise the various systems shall be UL listed where a UL listing exists for that component.
- B. Verify the completeness of the drawings, specifications, and schedules and the suitability of devices including AV equipment firmware to meet the design intent of the specifications.
- C. Contractor Shall provide any additional equipment, accessories, or incidentals required, whether specifically mentioned herein, without claim for additional payment, it being understood that a complete operational system is required.

1.012 RACEWAY AND BOXES

- A. Coordinate with Division 26.
- B. See specification Sections 26 05 33 - Raceway and Boxes for Electrical Systems and 27 05 33.41 - Raceway and Boxes for Audio-Video Systems and drawings.

1.013 CABLING

- A. Per manufacturer’s requirements and guidelines.

1.014 TWISTED PAIR CABLE

- A. Per manufacturer’s requirements and guidelines.

1.015 DIGITAL VIDEO CABLING

- A. All digital video cabling shall be per manufacturer's recommendations and guidelines.

1.016 AV EQUIPMENT

- A. General
 - 1. Refer to project Drawings and "Equipment Schedule". EXECUTION

1.017 GENERAL

- A. Verify all dimensions and conditions at the project site. Submit any conflicts for resolution and coordinate their efforts with the AOR and AV Consultant for coordination of the conflicts, completion of work, avoid conflicts over scheduling, access, and locations of their work.
- B. The Project Manager shall be responsible for ensuring all floor boxes and back boxes noted as Standard, if applicable, are supplied to the Division 26 contractor for the project.
- C. The Division 26 Contractor shall ensure all power connections are installed as noted on the drawings. AV System Installer is responsible for providing a coordinated schedule of completion of each system or space to the Division 26 Contractor to ensure timely completion of AV installation.
- D. Provide and furnish all mounting brackets, raceways, sleeves, rack rails, termination plugs, jacks, faceplate mounting hardware, back boxes, and other unique components as necessary to securely mount equipment and panels.
- E. Coordinate with other divisions of work the interface of room systems including lighting control systems, motorized shades, motorized projection lifts, motorized projection screens, HVAC system, e.g., where noted on drawings.
- F. Furnish painting and finishing as may be required to match components, cabinetry, and room décor. Coordinate the color and finish of any visible element of the system with Project Manager approval.
- G. Determine the location for mounting projector/lift, camera, display device to ensure these mountings to be free from vibration or shake. If these mounting locations are not free of vibration or shake. Provide isolation mounting devices to ensure the projected video images are stable.
- H. Provide power control for selected equipment racks and AV devices including but not limited to what is shown on the bid documents. All devices should be capable of being shut down except for the control system, audio digital signal processor, and AV network switches. If a power sequencer is included in design, then the AV System Installer shall provide the power on and off sequence of equipment included on the schematic AV drawings.

- I. Provide to Agency the AV equipment MAC addresses and serial numbers for coordination with Agencies IT network administrator.
- J. Provide the firmware updates as needed for AV devices prior to final system testing.

1.018 SITE CONDITIONS

- A. Coordination:
 - 1. Coordinate all work with other on-site trades.
 - 2. Schedule and manage equipment delivery and make appropriate arrangements to coordinate with job site personnel for the proper receiving, handling, and secure storage of equipment delivered.
- B. Site Clean-up:
 - 1. Keep the project site free of all debris generated by the AV System Installer's work, to the satisfaction of the Owner or Construction Manager. Remove waste and debris related to the specified work from the site daily and shall leave the relevant areas and equipment clean and in an operational state. Repair any damage caused to the premises by the AV System Installer's installation activities, at no cost to the Owner.
 - 2. At the completion of work, remove all remaining waste materials, tools/job box belonging to the AV System Installer, construction equipment, machinery, and surplus materials.
 - 3. Confine operations at the site to the areas permitted in the Contract Documents and do not unreasonably encumber the site with materials or equipment.

1.019 WIRING AND TERMINATIONS

- A. Do not exceed manufacturer's recommendations for cable pulling tension. Where cable-pulling lubricant is used, the lubricant must not damage the conduit and cable sleeve materials and must not harden over time to prevent future pulls.
- B. Confirm Division 26 installation of a pull string in every conduit. If additional cables are pulled in after the initial cable pull, pull a nylon pull string with the added cable.
- C. Color-code all systems wiring with labeling and coding as submitted and approved by shop drawing. Cabling shall be continuous and shall not be spliced between equipment. Maintain color coding and tagging throughout the system at all accessible locations to the cabling.
- D. Communication cables passing through any plenum space and not encased in steel conduits, must be plenum rated for their entire length.
- E. The fire stop system shall comply with the latest editions of NEC and with NFPA 101-Life Safety Code and shall be made available for inspection by the local Authority Having Jurisdiction. The fire stop systems and products shall be UL tested and material shall be UL classified as materials for use in through-penetration fire stops.
- F. Verify the fire rating of all walls and floors affected by their work.

1.020 LABELING

- A. Equipment Racks & Rack-mounted Equipment
 - 1. See specification Section 27 05 53 – Identification for Communications Systems for label material, text and general installation requirements.
 - 2. Provide labeling for rack-mounted equipment with engraved and filled plastic laminate. Other methods of labeling rack-mounted equipment may be accepted upon prior approval by the AE Consultant and/or Owner.
 - 3. Provide labels of contrasting color for rack-mounted equipment and racks on both the front and the rear.
 - 4. Clearly label all racks, rack-mounted equipment, switches, controls, and panels unless noted otherwise.
 - 5. Panels and plates shall be a minimum of 1/8” thick anodized aluminum etched, and epoxy filled unless noted otherwise.
 - 6. Permanently mark each wire with a number at each end. Labels must be printed. Do not use adhesive wire labels from wire from books.
 - 7. Coordinate with Division 26 to ensure that power receptacles within each rack and at remote equipment locations are labeled and match to the appropriate panel and circuit breaker.

1.021 EQUIPMENT RACKS AND CABINETS

- A. Assemble equipment racks using best industry practices and tested off-site before on-site delivery and installation. No rack assembly shall be allowed on site depending on size and time frame of project without being completely wired except for terminations of field wiring to the rack.
- B. Bond all equipment racks to the ground. Refer to specification Section 26 05 26..
- C. Ensure that all equipment is installed with cooling and ventilation.
- D. Coordinate with Division 26 contractor and construction manager the delivery of assembled racks to the construction site. Protect racks from dust, construction debris and other job site hazards during the entire duration of the installation. Depending on project timeline and size of the project.
- E. Thoroughly clean all racks and equipment contained therein upon completion of the project and just prior to turn over.
- F. Security covers designed to limit tampering of preset levels shall conceal all rack-mounted equipment not requiring frequent adjustment. Install blank and or vented panels as needed to fill unused spaces in racks.

1.022 RIGGING

- A. Install and mount equipment specified herein.

- B. Provide drawings detailing mounting methods as well as attachment points and load ratings to building structure. If required by the AV Consultant, a structural engineer should sign/stamp the drawings.
- C. Coordinate with all applicable trades. The rigging installer shall have experience in load calculations and the needed installation practices for safe rigging as the project equipment may require.
- D. Provide safety wire of sufficient strength to anything suspended over audience areas excepting those that have three or more suspension points.
- E. Minimum safety factor for all mounting and rigging: 5:1.
- F. AV devices shall not share or utilize supporting structures intended for other systems.

1.023 GROUNDING

- A. Do not connect metallic raceway of any type to equipment racks. This includes but is not limited to AC power and AV conduits. Ground equipment racks using stranded copper wire conductors connected only to isolated technical ground buss and bonded to equipment rack ground buss.
- B. Isolate AV equipment racks that have metal wheels or metal based leveling feet from floor by use plywood sheeting. Paint all six surfaces of the plywood with fire retardant paint. Isolate equipment rack AC receptacles from equipment rack by use of isolated ground receptacles.
 - 1. *Exception:* Plywood sheeting is not required if equipment rack has isolating plastic or rubber wheels or isolating plastic cap leveling feet.
- C. Connect receptacle-isolated grounds only to isolated technical ground buss.
- D. Refer to 26 05 26 articles “CONDUCTORS” and “COMMUNICATIONS SYSTEM GROUNDING”.

1.024 AV SYSTEMS CLEAN POWER

- A. Do not use installation methods, practices that may compromise AV systems isolated ground, clean power scheme. Complete description and specifications for AV systems isolated ground clean power system listed in article section 26 05 26.

1.025 TECHNICAL REQUIREMENTS

- A. Speaker and Amplifiers
 - 1. Install manufacturer-provided security covers over all amplifier gain knobs.
 - 2. Label each amplifier with which speaker zones each amp channel is driving.
 - 3. Set gain levels for appropriate gain structure and maximum range of system volume.
 - 4. Sequence power so amplifier is last device to turn on and first device to turn off.
- B. Speakers (Ceiling, Pendant, Wall-Mounted and Suspended Type)
 - 1. Include custom painting in bid.
 - 2. Coordinate color with Architect and Owner prior to installation of speaker grills.
 - 3. Coordinate color with Architect and Owner prior to purchase and installation of suspended speakers, wall mounted speakers, and pendant speakers.
 - 4. Provide all required rigging hardware.
 - 5. Provide all required mounting hardware including safety cabling.
 - 6. Provide free air cable support.
 - 7. Schedule and coordinate speaker placement with other trades.
- C. Digital Video System
 - 1. Provide Video Media Test reports for each system.
 - 2. Adjust Video Media transmitters and receivers for proper EDID tables and resolutions confirmed with project and OFCI devices.
 - 3. Video Media Receivers shall be set to maintain aspect ratio as determined by display orientation.
 - 4. Transmitters shall be set to auto switch between Digital and Analog inputs.
 - 5. Provide Owner with complete list of all IP address.
 - 6. Adhere to streaming specifications for each AV product manufacturer as they have different requirements for each product.
 - 7. Coordinate V-LAN'S and IP schemes with owner.
- D. Equipment Racks
 - 1. Coordinate with Division 26 Contractor to maintain isolated ground.
 - 2. Provide mounting hardware as required.
 - 3. Provide power distribution for all equipment located within rack.
 - 4. Provide rack screws as required.
 - 5. Coordinate equipment to be mounted in equipment racks including OFCI provided equipment.
 - 6. Provide appropriate equipment ventilation for equipment to operate at or below 80 degrees Fahrenheit.
 - 7. Provide blank panels for all unused rack spaces.
- E. Floor Boxes and Poke-Thru Assemblies and Outdoor Boxes
 - 1. Coordinate with Division 26 and Telecom/Data Installer to ensure all required power and connectivity are provided for in the Box and/or Poke-Thru Assembly design.
 - 2. See PART 1 direction re: mock-ups.
- F. Front Fill Loudspeakers
 - 1. Drive front fill speakers with a separate output from the DSP or mixing console.

2. Coordinate color with architect prior to installation.
- G. Input/Output Panels
 1. Mount at standard outlet height unless otherwise indicated in plans.
 2. Coordinate finish with Architect prior to purchase or installation.
 3. Confirm nomenclature of engraved labels with AE Consultant and Owner prior to ordering by submitting panel layouts with submittal package. See PART 1 Article SUBMITTALS.
 4. Confirm number sequence of inputs and outputs with AE Consultant and Owner prior to ordering.
- H. Interconnect Cables
 1. Provide analog and digital interconnect cables/wiring for AV system inputs/outputs.
- I. Loudspeakers and Emitters
 1. Verify cabling routes, distances, paths between speakers, and mounting hardware manufacturer.
 2. Provide all required mounting hardware including safety cabling.
 3. Coordinate speaker placement with other trades (HVAC, lighting, fire protection, etc.).
 4. Coordinate Color with Owner / Architect.
 5. Provide additional speaker cable support as required. Where mounting in ceiling tile, provide support in the form of a Tile Bridge or other means. Do not support speaker solely by ceiling tile.
- J. Projectors
 1. Coordinate with AV Consultant and Owner on projector mounting positions with site conditions, image sizes, aspect ratios, and projector throw ratios prior to purchasing projectors.
 2. Provide vibration isolation and additional support as required to stabilize projected image.
 3. Provide the appropriate lens for all projectors. Field coordinate projector locations with other ceiling elements.
 4. Projector mounting height shall be placed for optical alignment with projection screen so that keystone shall not be engaged.
- K. Projection Screens
 1. Self-perform or coordinate as needed to ensure proper configuration and installation of projection screens..
 2. Confirm mounting locations of screens.
 3. All electric projection screens assumed to have 2" black drop unless otherwise noted.
 4. Verify Black Drop in-field prior to procurement.
 5. Provide adjustments to final trim of screens.
 6. Tab-tensioned screens shall have no more than 4 inches of screen fabric on screen roller when screen is at presentation trim.

1.026 COMMISSIONING

- A. AV System Commissioning. Includes Testing and Acceptance requirements and Commissioning Checklists.

1.027 DOCUMENTATION

A. General

1. Upon City's and AOR's acceptance of the installed system, provide documentation as detailed below.
2. Submit all documentation in electronic form.
3. Provide:
 - As-built Drawings
 - Maintenance and Operations Manuals
 - Test and Measurement Report
 - Construction Verification Checklists

B. As-built Drawings

1. Provide updated Shop Drawings documenting as-built conditions for each system and room, including:
 - Floor and Ceiling Plans showing device locations
 - Schematics with wire-numbers
 - Rack Elevations
 - Power and Grounding. Include sequencing schedule where applicable.
2. Provide in Adobe PDF format. PDF shall be searchable and with each section bookmarked. Where original document is AutoCAD or REVIT generated, provided AutoCAD dwg file(s) also. Confirm AutoCAD file format version with City.
3. Identify as a Record Document (RD) and date on sheet or in the Title Block.

C. Maintenance and Operations Manuals

1. Refer to DIVISION 1 - GENERAL REQUIREMENTS
2. Provide copies of approved submittals per specification Documents should include products used on the project.
3. Provide User Manuals for all equipment provided.
4. Provide Equipment List that includes make/model and serial numbers of all installed equipment.

1.028 TRAINING

- A. General
 - 1. Coordinate and schedule training with Agency selected team members and AV system installer design team.
 - 2. Training shall be conducted at the project site using the project equipment for each unique system.
 - 3. Training must cover, at minimum, the following items:
 - 4. User Manual:
 - a. The manual outlined in Part 1, Maintenance and Operating Manuals, detailing the system functions.
 - b. Control Systems Programmer operations for each AV system.
 - 5. Technical User:
 - a. Operations training on equipment and software use.
 - 6. Maintenance User:
 - a. Updates and physical maintenance (cleaning of displays, bulb changes, filter cleaning, filter changing, etc.).

END OF SECTION

SECTION 27 1013 - STRUCTURED CABLING (EXISTING SITES)

PART 1 - GENERAL

1.01 SUMMARY

- A. This section describes the products and execution requirements relating to furnishing and installation of Communications Cabling and Termination Components and related sub-systems as part of a Structured Cabling System for the project. The specified cabling may support “voice”, “data”, audiovisual and networked security applications as noted.
1. Comply with individual system specifications.
- B. Principal items of Work in this Section shall include labor and materials that consist of provisions, installing, terminating, testing, and documenting a complete and fully functional communications structured cabling system. The work shall include the following:
1. Local Area Network Wiring:
 - a. Provide a plan that includes coordination of required installation efforts with the Telecommunication and CATV Access Providers. This includes installation of new duct banks and vaults for telecommunications cable for Telecommunications and CATV.
 - b. Furnish and install cabinets/racks, vertical power strips, cable trays and cable management at the MDF.
 - c. Furnish and install modular T-568-B patch panels for termination of UTP within the MDF, IDF, and LDF. Use fiber patch cabinets for fiber optic cable terminations located in the MDF, IDF, and LDF where copper drops are provisioned.
 - d. Furnish and install connectors and faceplates and terminate cable as specified.
 - e. Provide high impact plastic wall and/or faceplate covers and connector housings for communication systems outlet locations.
 - f. Provide contiguous (home run cables with service loops) optical fiber and copper backbone, link and distribution cables. No splices are permitted between designated termination points.

- g. Furnish and install floor mounted equipment racks, with required CBC Seismic Design rated seismic bracing and associated accessories in telecommunications spaces where required.
- h. Furnish and install grounding and bonding of communications components per the CEC.
 - 1) Telecommunication Entrance Facilities, Minimum Point of Entry locations, and MDF locations shall be equipped with a telecommunications main grounding busbar or telecommunications grounding busbar as appropriate to the installation environment.
 - 2) Grounding Equalizers or Telecommunications Bonding Backbone Interconnecting Bonding Conductors are not required except in buildings exceeding two occupied stories which use building steel to ground electrical service panels.
 - 3) In buildings with two stories or less, where electrical panels are grounded using CEC compliant grounding conductors directly connected to the building ground electrode, IDFs, and LDFs equipment chassis; associated peripherals shall use local panel ground via the equipment branch circuit grounding conductor.
- i. Furnish and install full labeling of the entire installation prior to testing in accordance with Article 3.04 paragraph C of this specification.
- j. Premise cable shall be tested in compliance with Specification 27 0126. Testing of each LAN optical fiber element and connector with Power Meters and OTDR. For multi-pair copper communications cable, test pairs within counts and binder groups to ensure that no less than 99 percent of the pairs of a multi-pair cable achieve continuity and operation in voice band tests. For Category 5E copper cable, test and certify 100 percent of drops using test equipment certified for Level IIE test equipment.

C. Related Requirements:

- 1. Section 00 7000: General Conditions.
- 2. Division 01 - General Requirements.
- 3. Section 06 1000: Rough Carpentry.
- 4. Section 26 0526: Grounding and Bonding.
- 5. Section 27 4100: Audio-Video Systeme.

D. Acronyms: See Appendix 1.

E. Definitions: See Appendix 2.

F. References

1. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association and present manufacturing standards. All materials shall be listed by UL and shall bear the UL label. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

1.02 SYSTEM REQUIREMENTS

A. General:

1. This specification describes the design, installation, testing, and documentation of elements for premise wiring installations and should be read in conjunction with other applicable divisions and sections of the contract documents. Furnish labor, supervision, tooling, miscellaneous mounting hardware, and consumables, including patch cables. Provide necessary labor and materials for a complete and operable installation.

1.03

1.03 SUBMITTALS

A. General

1. Under the provisions of Division 1, prior to the start of work, submit:
 - a. Shop Drawings
 - b. Contractor Qualifications
2. Group Submittals to include complete documentation of related systems, products and accessories in a single submittal.
3. Submittals shall be electronic format (ADOBE Portable Document format “.pdf”) copies of manufacturer datasheets.
4. Identify each proposed product with a mark or reproducible highlight.
5. Where multiple options for a particular product may apply (color, construction, features, etc.), identify the applicable option(s).
6. Where applicable, mark dimensions in units to match those specified.
7. The Engineer shall review the Submittals and through annotation and/or a cover sheet, provide comment.

8. Work shall not proceed without the Engineer's review of the submitted items.
9. Additional submittals (Test Plan, Test Results, Documentation, Record Documents, etc.) required during and in follow-up to construction are detailed in Part 3.

B. Shop Drawing Submittal

1. Submit documents including:
 - a. Manufacturer's Product data for all products proposed indicating construction, materials, ratings, and all other parameters identified in Part 2 (Products) below. Structured Cabling submittal shall include Test Data confirming Horizontal Cabling Channel Performance.
 - b. Manufacturer's installation instructions.
 - c. Upon request by the AOR, one (1) two-foot section of each cable type to be utilized for final approval by the Engineer. This two-foot section shall have the manufacturer's cable markings visible. Upon request, samples from every reel sent to the site shall be provided

C. Contractor Qualifications

1. Provide certification documents confirming contractor status as an active participant in Installers Program operated by Manufacturer of Cabling or Termination Components used.
2. Upon request, furnish project experience as identified under "Quality Assurance / Contractor Qualifications" above.
3. For each project listed provide:
 - a. Name and location of installation
 - b. Date of initial operation of system by owner. (Minimum period of operation for referenced project shall be 12 months)
 - c. Owner's representative to contact and their telephone number

1.04 CODES AND STANDARDS

A. Complete installation shall meet or exceed the latest edition of following standards:

1. Underwriters Laboratories Inc. (UL): Applicable listings and ratings.
2. UL 50, Cabinets and Boxes.

3. UL 943, GFCI.
4. UL 489, Molded Case Circuit Breakers.
5. California Building Code.
6. California Electrical Code.
7. California Electrical Code, Article 384, 770, 800, latest issue.
8. National, State, and Local Occupational Safety and Health Administration (OSHA) building and fire codes.
9. NEMA PB1.
10. Federal Specifications W-P- 115C and WC-375B.
11. ANSI/TIA/EIA Telecommunications Building Wiring Standards.
12. ANSI/TIA-568-C, Commercial building telecommunications wiring standard and current addenda.
13. ANSI/TIA/EIA-568-C.3 Optical Fiber Cabling Components Standard.
14. ANSI/TIA/EIA-569-B, Commercial Building Standard for Telecommunications Pathways and Spaces, current issue.
15. ANSI/TIA/EIA-569-A-1, Commercial Building Standard for Telecommunications Pathways and Spaces Addendum 1 - Surface Raceways (March 2000).
16. ANSI/EIA/TIA-598-A, Optical Fiber Cable Color Coding, current issue.
17. ANSI/TIA/EIA-606-A, The Administration Standard for the Telecommunications Infrastructure of Commercial Building, current issue.
18. ANSI/TIA/EIA-607-A, Commercial Building Grounding and Bonding Requirements for Telecommunications, current issue.
19. ANSI/TIA/EIA-758-A, Customer-Owned Outside Plant Telecommunications Cabling Standard, current issue.
20. Institute of Electrical and Electronic Engineers (IEEE) 802.3 (Ethernet), 802.3Z (Gigabit Ethernet over optical fiber), 802.3ab (Gigabit Ethernet over 4 pair category 5 or higher), 802.11 (Wireless LAN).
21. BICSI Telecommunications Distribution Methods Manual, current issue.
22. FCC Part 68.50.

23. National Electrical Manufacturer's Association (NEMA).
24. National Fire Protection Association (NFPA), NFPA-70.
25. CCR Part 3 - California Electrical Code.
26. CCR Part 2 - Uniform Building Code.

1.05 SYSTEM DESCRIPTION

- A. Local Area Network Cabling Infrastructure: The network-cabling infrastructure at each school will utilize a star topology design consisting of horizontal cabling, backbone cabling, and various telecommunications cabling pathways and spaces. Schools will require design-engineering services to determine the best route and method for cable conveyance throughout the school in accordance with project requirements and applicable installation standards.
1. Proposed solutions shall be in compliance with TIA/EIA 568-C, centralized optical cabling, with the single exception of allowable cabling distance. TIA/EIA 568-C Annex A allows 300 meters as a maximum multi-mode optical fiber cable distance but District specification allows a maximum total length of 550 meters (450 meter backbone + 90 meter horizontal) using high grade laser optimized 62.5 micrometer multi-mode optical fiber. The installation of the backbone and horizontal cable plant shall include the following:
 - a. 62.5 micron multi-mode solutions which require mode-conditioning patch cords when using VCELS to launch in the 850 nm launch window shall not be accepted.
 - b. The interconnect or splice method as shown in figure 3 of ANSI/TIA 568-C shall be used in all cases. The pull through and splice methods are not acceptable.
 - c. Installation of optical fiber backbones in strand counts adequate to cross-connect active classroom, and instructional support location horizontal fiber to the BBS including a minimum of 10 percent spare strands, in multiples of six strands, in each backbone cable. Fiber termination units (FTU) are required to cross-connect backbone fiber at both the main equipment (MDF) cross-connect and at secondary (IDF) cross-connect locations throughout the campus.
 2. Backbone Cabling - The backbone cabling as a minimum, unless otherwise noted, shall be an indoor-outdoor, Riser rated hybrid multi-mode/single-mode fiber optic cable with a minimum composition of 12 strand multi-mode and six strand single-mode fiber optic cabling for inter-building and intra-building backbone cabling. Backbone cables shall meet or exceed the ICEA-S-104-696 Standard for Indoor-Outdoor Optical Fiber Cable. Connectors, distribution panels, ferrules, enclosures, and consumables shall be included to provide the

backbone connectivity between MDFs and IDFs. Designer will show calculations and provide drawings illustrating distance limitations.

3. Horizontal Cabling – Each data outlet unless otherwise noted shall consist of either one Category 5E cable or one Category 5E and four strands of fiber optic cable for classroom locations and six strands for connection to LDFs in locations such as computer labs, libraries and cafeteria.
 - a. Each Category 5E cable shall be terminated on an eight-position, eight-conductor Category 5E jack wired in accordance with T568B. Associated faceplates shall accommodate two jacks at a minimum. Within classrooms and other open spaces, Category 5E cabling shall be routed via EMT conduit or surface mount raceway in walls, and in J-hook in accessible spaces above ceilings, cables shall be routed from the patch panel to a data outlet and placed as close to each workstation as practical. Supply Category 5E rated patch panels and same manufacturer patch cords for telecommunications closets and workstations to maintain an end-to-end Category 5E channel for - horizontal cabling.
 - b. Existing horizontal fiber terminated at a user station may be rerouted to new network cabinets. Remove any obsolete secondary backbone fiber with new cabling where appropriate.

1.06 QUALITY ASSURANCE

A. Manufactured Items

1. The manufacturer(s) of cabling and connectivity components shall be a company specializing in and having a minimum of five years documented experience in producing products similar to those specified in this and related sections.

B. Contractor Qualifications

1. Contractor shall have necessary certifications to provide for Guarantees as specified herein.
2. Contractor shall have on the project team at a minimum one (1) certified Installer trained by the manufacturer(s) of the cabling, hardware and accessories installed under this project
3. Member of each test team shall be factory trained/certified in use of the test equipment. The project foreman shall have been factory trained in the use of the test equipment.

C. Mockups

1. Provide on request, mockups for Equipment Outlet configurations, especially those for Wireless Access Points, surface-mounted, harsh environment and

other unique conditions as applicable to verify selections made under Sample submittals, to demonstrate configuration, capacity and aesthetics and to set quality standards for fabrication and installation. Coordinate with Division 26 and other Division 27 requirements as applicable to include all power and communications devices.

1.07 WARRANTY

- A. Warranty that work executed and materials furnished shall be free from defects in materials, fabrication and execution for a minimum period of three years from date of installation acceptance, excluding specific items of work that require a warranty of a greater period that may be set forth in this Specification. In the event a manufacturer's warranty is longer than three years, the manufacturer's warranty shall be the warranty period. Immediately upon receipt of written notice from the District, repair or replace at no expense to the District, any defective material or work that may be discovered before final acceptance of work or within the warranty period; any material or work damaged thereby; and adjacent material or work that may be displaced in repair or replacement. Examination of or failure to examine work by the District shall not relieve Contractor from these obligations.
- B. Provide a performance warranty for the installed data cabling system and components for a minimum of fifteen years after system is turned over to the Owner. Components of the optical data backbone cable system including cables, distribution shelves, LIUs and connectors must carry a fifteen year single manufacturer's applications warranty at speeds of one Gbit/second.

PART 2 - PRODUCTS

2.01 EQUIPMENT STANDARDS - APPLIES TO ALL SYSTEMS

- A. Where required by Specifications, components installed under this Contract shall be listed by UL or another Nationally Recognized Testing Labs (NRTL).
- B. Equipment Requirements.
 - 1. Various manufacturers' equipment may meet the standards of quality set by the Owner. Provide equipment specification sheets for items included in the submitted bid.
 - 2. The Owner's Quality Control representative or designated agent will establish equivalency and compliance of product or components offered for use under this Contract.

2.02 LOCAL AREA NETWORK CABLING

- A. Multi-Mode Optical Fiber.

1. The optical fiber shall be multimode, graded-index optical fiber waveguide with nominal 62.5/125 micron core/cladding diameters. The optical fiber shall comply with ANSI/EIA/TIA-492AAAA.
2. The mechanical and environmental specifications for multi-mode fiber distribution cables shall be indoor/outdoor, riser rated, tight-buffered type cables. The cable shall meet the requirements of the California Electrical Code (CEC) section 770 and the requirements of TIA-455-82B water ingress test. Confirm that the cable is listed for the specified application.
3. Cabled optical fiber shall meet the graded-index attenuation performance specifications of ANSI/TIA 568-C including current sub sections and addendum. Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-46, -53, or -61. Information transmission capacity shall be measured in accordance with ANSI/EIA/TIA-455-51 or -30. The cable shall be measured at 23 degrees C \pm 5 degrees C.
4. Multi-mode optical fiber shall meet the following minimum performance requirements:
 - a. Attenuation: The maximum attenuation of the multi-mode laser optimized fiber shall be 3.5db/km or less at 850nm and 1.5db/km or less at 1300nm.
 - b. Utilize GbE Gigabit Enhanced 62.5/125 multi-mode fiber to exceed standard bandwidth and distance limitations. Cable manufacturer shall guarantee that the multi-mode optical cable will support Gigabit Ethernet transmission up to 550 meters using SX optics.

B. Single-Mode Optical Fiber.

1. Single-mode optical fibers shall be Class IVa Dispersion-Unshifted Single-mode Optical Fibers and shall comply with ANSI/EIA/TIA-492BAAA. Fiber conductors shall have a nominal core diameter of 8.7 microns. Cable shall have transmission window centered at 1310 and 1550 nanometer wavelengths.
2. The mechanical and environmental specifications for single-mode fiber distribution cables shall be indoor/outdoor, riser rated, tight-buffered type cables. The cable shall meet the requirements of the National Electrical Code (NEC) section 770 and the requirements of TIA-455-82B water ingress test. The Installer shall confirm the cable is listed for the specified application.
3. Cabled optical fiber shall meet the attenuation performance specifications of ANSI/TIA-568-C. Attenuation shall be measured in accordance with ANSI/EIA/TIA – 455-78ASP-3-3644-RV2 or 61. The cable shall be measured at 23 °C \pm 5 °C.

- C. Fiber Optic Connectors. Fiber optic connectors shall be Duplex SC type, MM or SM connector.
- D. Fiber Optic Light Interconnection Units (LIUs). Rack mounted with the capacity to handle a minimum of 18 terminated fibers. Complete kit to include panels' bulkheads and supporting hardware.
 - 1. LIU for Local Distribution Frames and other locations requiring 18 optical fiber strands or less shall not exceed one EIA rack unit in height.
- E. Fiber Optic Distribution Shelves. 72 port rack mountable, with SC-compatible bulkheads and built-in cable management.
- F. Multimedia patch panels for LDC and LDF cross connections: Rack mounted field configurable panels for mixed media installations. The panel shall have a variety of modular inserts which support as a minimum Category 5E and duplex SC connectors.
 - 1. Patch panels for LDF cabinets shall support a minimum of three duplex SC optical fiber connectors and Category 5E connections as required by the number of drops supported at that distribution point.
- G. Fiber Optic Jumper Cables.
 - 1. Multi-mode or Single-mode duplex cable, OFN rated. Length: three meters, at a minimum, pre-manufactured with SC-SC connectors with same transmission characteristics as the terminated fibers as defined in Article 2.02.
 - 2. Fiber optic patch cables shall be supplied in sufficient quantity to connect each active fiber pair at intermediate cross-connect locations identified in the construction documents. Patch cables are not required for spare fibers. Intermediate cross connect locations include the following:
 - a. MDF – cross connect between the MDF and MPOE and MPOP.
 - b. IDF – cross connect between primary backbone and secondary backbone or horizontal fiber.
 - 3. Fiber optic patch cables shall be OFN type, jacketed with polyvinyl chloride with yellow indicating a single-mode patch cable and orange indicating a 62.5/125 multi-mode patch cable. The cable shall meet requirements of TIA/EIA-568 except for the more stringent requirements on bandwidth and attenuation identified in this Specification.
- H. Fiber Optic Innerduct. Materials: one-inch and/or one and one half inch, orange corrugated with pull rope, rated as required by code.
- I. Category 5E data Cable. Horizontal enhanced Category 5 cabling shall be 24 AWG, four-pair UTP, UL/NEC rated, with appropriately rated PVC (riser) or FEP (plenum) jacket as appropriate to the installation environment and N.E.C. Individual conductors

shall be FEP or polyethylene insulated as appropriate to the installation environment. Cables installed in cable trays or on “J”-hooks shall carry a CMP rating regardless of the installation environment. Cable shall meet ANSI/TIA/EIA minimum requirements for return loss, propagation delay, delay skew, NEXT loss, PSNEXT loss, FEXT loss, ELFEXT, and PSELFEXT for four-pair Category 5E cabling as detailed in ANSI/TIA-568-C.2. Category 5E data cabling and patch cables shall be blue or green.

- J. Flooded Category 5E cable for underground applications: Enhanced category 5 cabling shall be 24 AWG, four-pair UTP, UL/NEC rated, with appropriately rated polyethylene jacket with water blocking flooded core. Individual conductors shall be polyethylene insulated. Cable shall meet ANSI/TIA minimum requirements for return loss, propagation delay, delay skew, NEXT loss, PSNEXT loss, FEXT loss, ELFEXT, and PSELFEXT for four-pair Category 5E cabling as detailed in ANSI/TIA-568-C.2.
- K. Category 5E Inserts. Category 5E data inserts shall be wired to the T568B wiring pattern. Category 5E data inserts shall meet ANSI/TIA/EIA minimum requirements for return loss, propagation delay, delay skew, NEXT loss, PSNEXT loss, FEXT loss, ELFEXT, and PSELFEXT for Category 5E connecting hardware as detailed in ANSI/TIA/EIA-568. Category 5E data inserts shall be blue or green in color as consistent with the cable jackets for this system.
- L. Exterior Category 5E data drops shall be embedded in an environmentally sealed enclosure with an IEC NEMA 6 rating for Protection from live or moving parts, dust, and protection from immersion in water) and with an ADC 110 punchdown contacts for field termination of horizontal backbone cable of specified length. The connector shall combine existing RJ-45 connector technology with weatherproof housing assemblies and shall be compatible with standard Category 5E RJ-45 connectors. The exterior Category 5E connector shall interlock with exterior patch cord as described in paragraph 2.02.N of this Specification, and provide a seal with a NEMA 6 rating. Category 5E data inserts shall be wired to the T568B wiring pattern. Category 5E data inserts shall meet ANSI/TIA minimum requirements for return loss, propagation delay, delay skew, NEXT loss, PSNEXT loss, FEXT loss, ELFEXT, and PSELFEXT for Category 5E connecting hardware as detailed in ANSI/TIA-568-C.2.
- M. Category 5E Patch Cords. Patch cords shall be Category 5E rated, 24 AWG, four pair assemblies. Patch cords shall be factory assembled by the manufacturer of the cabling system. LAN Patch cords shall be the same color, blue, or green as the cabling system. Provide and install Category 5E patch cords as follows:
 - 1. One two-meter Category 5E patch cord for each work area outlet installed.
 - 2. In the wiring closets, Category 5E patch cords shall be provided in a like manner (one per user port). Patch cords shall be provided in varying lengths to accommodate a patch that can be neatly loomed into the cable management system. In wiring closets and passive patch locations, patch cords shall be installed and shall cross connect structured cabling to LAN equipment ports.

- a. In LDF locations in cabinets with less than 26 inches of rack space, Patch cables shall be provided in the following distribution of lengths – 30 percent one foot; 40 percent two feet; 30 percent three feet.
 - b. In MDF, IDF, and LDF locations in stand-alone cabinets with between 26 inches and 56 inches of rack space, patch cords shall be provided in the following distribution of lengths – 60 percent one meter; 40 percent two meters.
 - c. In MDF and IDF locations in cabinets with more than 56 inches of rack space, or ganged cabinets, patch cords shall be provided in the following distribution of lengths – 20 percent one meter; 40 percent two meters; 40 percent three meters.
- N. Category 5E patch cords for exterior locations. The patch cord shall combine existing Category 5E RJ-45 plug technology with weatherproof assemblies and shall be compatible with standard Category 5E RJ-45 connectors. One end of the ten foot patch cord shall be a Category 5E RJ-45 plug embedded in a housing that creates an environmental seal, a strain relief, and a locking mechanism when mated to exterior Category 5E connector, and an ingress protection of NEMA 6. See paragraph 2.02 L of this Specification. The other end of the patch cord shall be a standard Category 5E RJ-45 plug connector.
- O. Category 5E Patch Panels. Patch Panels shall be provided in 24 or 48 port compliments with modular jack ports wired to T568B. Patch panels consisting of 48 ports or less shall not exceed one EIA rack unit in height. Patch panels shall be augmented with cable support bars in rear to properly dress cable. Patch panels shall meet ANSI/TIA/EIA minimum requirements for return loss, propagation delay, delay skew, NEXT loss, PSNEXT loss, FEXT loss, ELFEXT, and PSELFEXT for Category 5E connecting hardware as detailed in ANSI/TIA/EIA-568. Quantity and size of patch panels must be selected to provide 20 percent expansion capacity. One EIA rack unit of horizontal wire management shall be provided adjacent to each patch panel both above and below.
- P. Outlet Gang Boxes. As a minimum, the telecommunications outlet box shall be capable of housing four Category 5E terminations or two terminated optical fibers. The outlet box shall have the ability to secure the optical fiber cable and provide for a minimum fiber bend radius of one inch. Typically, the telecommunications outlet/connector box shall consist of a four inch by four-inch electrical box or surface mount box.
- Q. Weatherproof single gang outlet box shall be NEMA 3R rated, either flush mount or surface mount as shown on the Drawings. The weatherproof single gang outlet box shall be used for mounting exterior Ethernet outlets (See paragraph 2.02.L of this Specification). This outlet box shall be mounted inside a terminal cabinet for exterior Ethernet outlet.

- R. Faceplates. Faceplates shall be constructed of ABS molding compound and have the ability to accommodate one insert.
- S. Exterior faceplate shall be a single gang, two ports, and stainless steel plate. The faceplate shall be pre-punched for mounting use with weatherproof housing assemblies (paragraph 2.02 L.). The faceplate shall be gasketed and have an NEMA 12 rating.
- T. Fiber Faceplates. Fiber faceplates shall be constructed of ABS molding compound and have the ability to accommodate a minimum of two angled duplex multi mode or single mode SC connectors.
- U. Horizontal Cable Management panels shall be 19-inch rack mount with a minimum of four-management rings one-rack unit (1.75 inches) in height. Rings shall not exceed more than 1.75 inches in depth unless otherwise noted in the construction documents.
- V. Floor Standing Cabinet. Floor-standing equipment cabinet for MDF or IDF installation use as required. Cabinet shall provide at least 84 inches (48 EIA/TIA rack units) of total mounting space for 19-inch panels and 36 inches of usable interior depth. If two cabinets are required in an MDF, structured cabling components shall terminate within the same rack with the Backbone Switch. Cabinet shall be constructed of steel with 14-gage carbon steel front and rear adjustable mounting rails tapped for #10-32 screws on EIA spacing front and rear. Cabinet shall be tested and certified to the seismic specifications set forth by NEBS Telcordia Technologies GR-63-CORE. Cabinet shall be provided with a thermostatically controlled heat dissipation fan; textured antique finish; matching side panels and louvered top panel; a hinged, key locking, bronze-tinted acrylic window door in front keyed to Corbin Cat 90; and a full length, hinged, key-locking rear door keyed to Corbin Cat 90. Cooling fan thermostat shall be set at 78 degrees Fahrenheit. When installed, both doors shall be able to swing fully open. Cabinets shall be UL listed.
- W. Wall-Mounted Cabinet. Wall-mounted equipment rack for IDF and LDF locations. IDF cabinet shall provide at least 45 inches of mounting space for 19-inch panels (26 EIA/TIA rack units), a 22-inch main body and a minimum of 24 inches of usable interior depth. LDF cabinet shall provide at least 24 inches of mounting space for 19-inch panels (13 EIA/TIA Rack Units), a 22-inch main body and 24 inches of usable interior depth. Cabinet bodies shall be 14 gage or better, welded steel construction with 14-gage carbon steel front and rear adjustable mounting rails, tapped for #10-32 screws on EIA spacing, fully adjustable front-rear. Allowable deflection of an open cabinet when loaded to its maximum weight capacity, shall not exceed .75 inches (3/4 inches) Wall mount IDF and LDF cabinets shall be configured to have a minimum of 18 inches from front to rear rack-mounting rails. Cabinet shall have factory made top or side ventilation capability and a thermostatically controlled heat dissipation fan rated at no more than 32dBA, a Plexiglas front door, and flush mounted locks on both front and rear sections. The front lock shall be keyed to Corbin CAT 90 and the rear lock shall be keyed to Corbin CAT 90. Cooling fan thermostat shall be set at 78 degrees Fahrenheit. Cabinets shall be provided with white powder coat finish. Cabinets shall be UL listed.

2.03 SIGNAL TERMINAL CABINETS

- A. Cabinets shall be code gage galvanized steel or blue steel; fronts, doors, and trim shall be code gage furniture steel. Cabinets shall be furnished with at least six-inch high gutters at top and bottom where feeder cable size exceeds four gage or where feeder cable passes through cabinet vertically. Cabinets shall be furnished with top and bottom gutters sized as required by inspection department having jurisdiction, but never less than six inches where more than one feeder enters top or bottom of cabinets. Side gutters shall not be less than four inches wide. Width of cabinets shall be 20 inches, unless otherwise indicated on Drawings.
- B. Doors shall be cut true, shall accurately fit opening, and finished smooth across joints. Rabbets shall be inside. Door shall be sized as required to permit removal of devices intact. Gutters shall be provided at sides and top of compartment. Hinges shall be entirely concealed except for barrels and pins. Hinge flanges shall be welded to door and trim. Doors shall be equipped with flush type, spring-latching, Corbin locks for metal doors keyed to Corbin No. 90 keys.
- C. Outdoor cabinets shall be NEMA Type 3R. Construction shall be formed from code gage galvanized steel with ANSI No. 61 gray enamel finish. Provide heavy-duty, three-point latching, vault type door handles with padlocking provisions. Provide stainless steel butt hinges on doors. Padlocks shall be furnished, keyed to Corbin No. 90 keys. Outdoor terminal cabinets shall be used only if approved by the Owner.

PART 3 - EXECUTION

3.01 GENERAL

- A. Refer to Project Drawings for major cable routes and termination location(s) within the building. Coordinate duct allocation with the AOR.
- B. Furnish and install all cables, connectors, hardware and equipment as shown on drawings and as specified above.
- C. It is the contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.
- D. Identifying and report to the City any existing damage to walls, flooring, tiles and furnishings in the work area prior to start of work. All damage to interior spaces caused by the installation of cable, raceway or other hardware must be repaired by the Contractor. Repairs must match preexisting color and finish of walls, floors and ceilings. Any contractor-damaged ceiling tiles are to be replaced by the contractor to match color, size, style and texture.

- E. Where unacceptable conditions are found, bring this to the attention of the City immediately. A written resolution will follow to determine the appropriate action to be taken.
- F. Project Design Intent is for cable fill in conduit for communications to not exceed 40% based on the maximum number of cables anticipated (initial requirement plus 25% growth) and a nominal assumed cable outside dimension of 0.25 inches". Identify to the DFD Construction Rep. shared pathways that do not provide this capacity.
- G. Beginning installation means contractor accepts existing conditions.
- H. Should it be found by the Engineer that the materials or any portion thereof furnished and installed under this contract fail to comply with the specifications and drawings with the respect or regard to the quality, value of materials, appliances or labor used in the work, it shall be rejected and replaced by the Contractor and all work disturbed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.
- I. Furnish, install, test and document all cables, termination components and support hardware unless noted otherwise.

3.02 EQUIPMENT RACK LAYOUT

- A. Position termination hardware as shown in project drawings.
- B. Position fiber optic termination hardware above other hardware.
- C. Layout equipment with horizontal management positioned at the top of the rack and adjacent to termination hardware as specified.

3.03 CLEANING AND INSPECTION

- A. Backbone optical fiber and copper pair counts in the cables to be supplied are detailed on the project drawings.
- B. Prior to construction, verify pair count with the engineer to confirm capacity of the backbone copper cabling to support the intended connectivity to the horizontal cabling.

3.04 CABLE INSTALLATION

A. GENERAL

1. Install all cables in continuous lengths from endpoint to endpoint. No splices shall be allowed unless noted otherwise.
2. Cable shall be suitable for and meeting the listing requirements of the installation environment through which it passes.
3. Furnish all required installation tools to facilitate cable pulling without damage to the cable jacket. Such equipment is to include, but not limited to, sheaves, winches, cable reels, cable reel jacks, duct entrance tunnels, pulling tension gauge and similar devices. All equipment shall be of substantial construction to allow steady progress once pulling has begun. Makeshift devices, which may move or wear in a manner to pose a hazard to the cable, shall not be used.
4. Pull all cable by hand unless installation conditions require mechanical assistance. Where mechanical assistance is used, care shall be taken to ensure that the maximum tensile load for the cable as defined by the manufacturer is not exceeded. This may be in the form of continuous monitoring of pulling tension, use of a "break-away" or other approved method.
5. Where recommended by the cable manufacturer, use a swivel between the pull-line and pulling grip to prevent the pull-line from imparting a twist to the cable.
6. Complete all work using qualified personnel utilizing state-of-the-art equipment and techniques. During pulling operation an adequate number of workers shall be present to allow cable observation at all points of duct entry and exit, as well as to feed cable and operate pulling machinery.
7. Pull cable in accordance with cable manufacturer's recommendations and ansi/ieee c2 standards. Manufacturer's recommendations shall be a part of the cable submittal. Recommended pulling tensions and pulling bending radius shall not be exceeded.
8. Install cable unenclosed, in a secured metal raceway, in cable tray or in modular furniture as designated on the plan drawings. All cable shall be free of tension at both ends.
9. Avoid abrasion and other damage to cables during installation.
10. Pulling lubricant may be used to ease pulling tensions. Lubricant shall be of a type that is non-injurious to the cable jacket and other materials used. Lubricant shall not harden or become adhesive with age.

11. All cable shall be free of tension at both ends. In cases where the cable must bear some stress, mesh-type (e.g., “kellm”) grips may be used to spread the strain over a longer length of cable.
12. Manufacturer’s minimum bend radius specifications shall be observed in all instances.
13. Within the equipment room in which cabling is terminated, use only hook and loop (e.g., “velcro”) ties from room entry to the point of termination. This is to facilitate the addition of future cables.
14. A pull cord (nylon; 1/8” minimum) shall be co-installed with all cable installed in any conduit.
15. Protection of cable and devices from foreign materials:
16. Coordinate with other trades and provide adequate physical protection during construction to prevent foreign material application or contact with cables and devices.
17. Foreign material is defined as any material that would negatively impact the validity of the manufacturer’s performance warranty. This includes, but is not limited, to overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.
18. Overspray of paint on any cable, cable jacket, termination component or device will not be accepted.
19. Use of any cleaning agents to remove overspray shall be per the cable manufacturer’s written consent.
20. Replace any component or assembly affected by a foreign material. This shall be at no additional cost to the project.
21. Should the manufacturer and/or warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced.

3.05 FIBER OPTIC CABLE INSTALLATION

- A. Provide cable slack in each backbone fiber optic cable. This slack is exclusive of the length of fiber that is required to accommodate termination requirements and is intended to provide for cable repair and/or equipment relocation.
 - 1. Store cable slack in a fashion as to protect it from damage and be secured in the termination enclosure or a separate enclosure designed for this purpose, in a loop secured to cable runway or wall. Multiple cables may share a common enclosure. Slack required in the various subsystems is as follows:
- B. Backbone Intra-Building: A minimum of 5-meters (approx. 15-feet) of slack cable (each cable) shall be coiled and secured at one (1) end - preferably at the Entrance Room and/or Main Equipment Room.
- C. Backbone Fiber Optic Cable [shall] [shall not] be installed in protective innerduct. [This includes areas where the cable is routed in cable tray and where making a transition between paths (e.g., between conduit & cable tray or into equipment racks).]

3.06 SPLICING PROCEDURE – FIBER OPTIC

- A. Size enclosure based on cable type(s), cable count and total fiber count. Counts shall not exceed maximums recommended by the splice closure manufacturer.
- B. Provide adequate slack cable to allow for splicing operation to be performed in a protected area.
 - 1. For cabling installed in underground ducts, this slack shall be adequate to perform the splice in a tent or vehicle positioned in an accessible area adjacent to the maintenance hole in which the splice is to be secured.
 - 2. For cabling installed on an aerial route, this slack shall be adequate to perform the splice in a tent or vehicle positioned in an accessible area adjacent to utility pole closest to where the splice is to be secured.
- C. Prepare Splice Enclosure and cables per manufacturers recommended procedures.
- D. Configure splice as a “Butt” splice (all cables enter same end of closure).
- E. Secure each cable central member and strength element(s) individually.
- F. Bond metallic cable elements and make continuous through the splice. Bond to ground
- G. Splice optical fibers using the fusion method. Individual splice loss shall not exceed:
 - 0.3 dB for Multimode fibers
 - 0.3 dB for Single-mode fibers

- H. Secure and protect finished splices in Splice Tray(s) per splice closure and cable manufacturer's recommendations.
- I. Complete and seal splice enclosure.
- J. Secure cable slack.
 - 1. For cabling installed in underground ducts, coil cable slack in maintenance hole. Diameter of coil shall meet minimum cable bend radius requirements.
 - 2. For cabling installed on an aerial route, run cable slack along messenger and use cable "snowshoe" product per manufacturer's recommendations.

3.07 HORIZONTAL CABLE INSTALLATION

- A. Refer to the project Drawings which identify the location of the Horizontal Cross-connect and Equipment Outlet (EO) locations.
- B. Route Horizontal Cabling to the designation identified in the Project Drawings.
- C. The maximum Horizontal Cable length shall not exceed 295-feet (90-meters). This length is measured from the termination in the wiring closet to the equipment outlet and must include any slack required for the installation and termination.
- D. Route horizontal cabling in a fashion as to avoid unnecessarily long runs. Identify and report to the engineer prior to installation any area that cannot be reached within the above constraints.
- E. Where installed unenclosed:
 - 1. Route cable at right angles and clear of other trades work.
 - 2. Support cables utilizing "J-Hook", "Bridle Ring" or similar supports anchored to ceiling concrete, or structural steel beams. Cable support devices shall be designed to maintain cables bend to larger than the minimum bend radius. J-Hooks shall incorporate a metal wire or other type closure to retain the cables. Bridle Rings shall be equipped with "saddles" to maintain the required bend radius.
 - 3. Space supports at a maximum 4-foot interval unless limited by building construction. Cable "sag" at mid-span shall not exceed 6-inches. Place additional supports as required to clear other trades work.
 - 4. Do not attach cables to or support cables using existing plumbing or steam piping, ductwork, raceways or cabling.
 - 5. Route cable to allow removal of ceiling tiles. Do not place cable directly on the ceiling grid or attach cable in any manner to the ceiling grid wires.

6. Limit cable bundles (e.g., those secured with cable ties) to (24) or fewer cables in each bundle.
- F. Cable routing shall not limit maintenance access to mechanical systems, piping (e.g., valves, takeoffs for future work), controls and other systems.
- G. Take care in the use of cable ties to secure and anchor the horizontal cabling. Do not overtighten ties as to compress the cable jacket. No sharp burrs should remain where excess length of the cable tie has been cut.
- H. Protect cable sheaths from damage from sharp edges. Where a cable passes over a sharp edge, provide a bushing or grommet to protect the cable.
- I. At Equipment Outlet locations, provide slack in each horizontal cable under 250-feet in length to allow for change in the office layout without re-cabling. These "service loops" shall be secured at the last cable support (e.g., J-Hook, Bridle Ring, etc.) before the cable leaves the ceiling. Minimum coil diameter shall be 8-inches. Secure coils with Hook & Loop cable ties.
- J. Slack cable length shall—unless noted otherwise on the project drawings—be as follows:
 1. Where cables enter a fishable wall, conduit, surface raceway or box: 4-feet.
 2. Location where cables are installed into movable partition walls or modular furniture via a service pole: 15-feet.
 3. At Wireless Access Point (WAP) and Security Camera locations: 20-feet.
- K. At all Telecommunication Rooms (TR), provide approximately 10-feet of slack in each horizontal cable to allow for changes in the telecommunication room layout without re-cabling.
 1. This slack shall not be required where a horizontal cable length in excess of 295-feet would result.
 2. Secure cable slack to the cable runway above the equipment racks.
 3. Cable bends shall be 200% of the cable recommended minimum bend radius or greater.
- L. Minimum separation distances between communications wires and cables, and any electric light, power, Class 1, non-powered fire alarm, or medium power network-powered broadband communications circuit shall comply with NEC Article 800.
- M. In addition, to reduce or eliminate EMI, the following minimum separation distances shall be adhered to:
 1. Thirty-nine (39) inches from transformers and motors.
 2. Cabling installed unenclosed or in cable tray shall be separated from fluorescent lamps and associated fixtures by a minimum of 5 inches (125 mm).

3. Zero pathway separation distance is permitted when electrically conductive communications cables, power conductors or both are enclosed in metallic pathways that meet the following conditions:
 4. Metallic pathway(s) completely enclose the power conductors and are continuous;
 5. Metallic pathway(s) are properly bonded and grounded per ANSI/TIA-607-B; and
 6. Walls of the pathway(s) have a minimum thickness 1 mm (0.04 in) nominal if made of steel (1/2" EMT minimum)
- N. No separation is required between power and communications cables crossing at right angles. The cables shall not, however, be supported by the power cabling.
- O. Sleeve all openings and fire-stop per prevailing code and building construction ratings upon completion of cable installation.

3.08 EQUIPMENT OUTLET

A. General

1. Mount outlets flush in wall-, ceiling- and/or ceiling mounted boxes, in floor boxes and/or poke-through assemblies, on Surface Raceway and in modular furniture. Refer to project drawings for applicable outlet types.
2. Mount level.
 - a. Unless noted otherwise on drawings, default mounting height (from finished floor to center line of outlet) in new installation shall be as follows:
 - 1) Standard Equipment Outlet 18-inches
 - 2) Outlet for Wall-Mounted Telephone per ADA
 - b. Assemble and terminate connectors per manufacturer's recommendations.
 - c. In shielded installations, assemble to ensure continuity between connector shield and cable shield.
3. Fit all Connectors (e.g., modular jacks and coaxial type) with a dust cover. If the modular jack design requires an integral dust cover, ensure that the covers are securely seated.
4. Secure Equipment Outlet faceplate using tamper-proof (security) fasteners. Confirm fastener type with agency prior to construction.

3.09 WIRELESS ACCESS POINT (WAP) LOCATIONS

- A. Unless noted otherwise on drawings, mount Equipment Outlet intended for use with a Wireless Access Point (WAP) as follows:
 - 1. Drop Ceilings - Cut ceiling tiles and deliver cabling into 4-11/16” square, deep outlet box mounted on a grid box hanger (a.k.a. “tile bridge”).
 - 2. Exposed Ceilings (surface mount) - cabling piped to a 4-11/16” square, deep outlet box. Unless mounted to structure, support outlet box using threaded rod or other means. Mount so assembly is horizontal.
 - 3. Reduce 2-gang or larger openings to 1-gang using “mud ring”.
- B. Equipment Outlet locations for Wireless Access Points as shown on drawings are approximate. Coordinate final locations with Agency.

CABLE TERMINATION

A. General

- 1. At the Telecommunications Rooms, position all Data and Voice Cables on termination hardware in sequence of the Outlet I.D. starting with the lowest number.
- 2. Termination Hardware (Blocks and Patch Panels) Positioning and Layout must be reviewed and approved by the Engineer prior to construction. The review does not exempt the Contractor from meeting any of the requirements stated in this document.
- 3. At each Equipment Outlet (or communications or security device where cable is terminated in a Modular Plug), terminate cabling per manufacturer’s recommendations and as identified in the above article “HORIZONTAL PERMANENT LINK”.
- 4. Where F/UTP cabling is installed, maintain continuity of the shield from Modular Patch Panel to EO or Modular Plug.

3.010 CABLE TERMINATION –BLOCKS

A. General

- 1. Refer to the Project Drawings which indicate mounting requirements for Termination Blocks.

2. Coordinate the placement of blocks with other cabling where applicable.
3. Provide spare capacity—unless otherwise noted on project drawings—as follows:
 - a. Provide Horizontal Blocks to accommodate minimum of 20% growth in the quantity of equipment outlets relative to the initial installation, adjusted upward to the nearest commercially available block size.
 - b. Provide Intra-building (ISP) Backbone Blocks to accommodate minimum 20% growth, adjusted upward to the nearest commercially available block size. Assume (1) that all four pairs in horizontal cabling designated as for “Voice” are cross-connected to the backbone cabling.
 - c. Size Blocks for Inter-building (OSP) Copper Backbone Cabling to include 30% growth relative to initial requirements, adjusted upward to the nearest commercially available block size.
 - d. Provide cable management hardware (e.g., D Rings and cable guides) to neatly and securely route cabling to the blocks.
4. Where wall-mounted blocks are specified:
 - a. Mount on a prepared surface (e.g., 3/4-inch plywood) securely fastened to the building walls. Plywood shall be fire-retardant type or be painted with fire retardant paint. Refer to plan drawings.
 - b. Provide Horizontal Troughs incorporating plastic or metal distribution rings shall be provided by the Contractor to accommodate routing of jumpers. Troughs shall be positioned at the top of each column of termination blocks and between each 100-pair wiring block.
 - c. Provide metal or plastic split distributing rings on both sides of the column of blocks to accommodate vertical routing of jumpers.
 - d. Where Horizontal and Backbone Cabling blocks are oriented vertically (rather than side-by-side), provide a backboard incorporating plastic distribution rings allowing for a change in direction in cross-connect wiring between the blocks of each type.
 - e. The Height of the Voice Termination Field shall not exceed 6-feet (72-inches) above floor level to facilitate cable maintenance.
 - f. Position Blocks on which Backbone and Horizontal Cabling are terminated in separate columns. Position Backbone Cabling to the Left; Horizontal Cabling to the Right. Position Blocks close proximity to simplify installation and subsequent tracing of cross-connect wiring.

g. Where new cabling is to be integrated with existing cabling at the building entrance, it will be the responsibility of the Contractor, in cooperation with the Owner, to coordinate placement of Voice Termination hardware with the Local Exchange Carrier(s) serving the site.

5. Route cables to wall-mounted blocks from below the blocks in a manner that will facilitate growth.

B. Cable Management

1. Provide Horizontal Troughs incorporating split plastic distribution rings to accommodate routing of jumpers. Troughs shall be positioned at the top of each column of termination blocks and between each 100-pair wiring block.

2. Position Rings between the Backbone and Horizontal Cabling Blocks for vertical routing of jumpers and/or cross-connect wiring.

C. Termination

1. For termination of Horizontal Cabling, use four-pair (e.g., C4-type) clips. The twenty-fifth pair of each row on the 110-type block located at the Horizontal Cross-connect (e.g., Telecom Room / IDF) shall not be used for termination of horizontal voice cable.

2. For termination of Backbone Cabling, use five-pair (e.g., C5-type) clips.

3. Ensure that the twists in each cable pair are preserved to within 1.0-inch of the termination for all Voice UTP backbone cables and within 0.5-inch for Category 5e and Category 6 cables. Remove cable jacket only to the extent required to make the termination.

3.011 CABLE TERMINATION - MODULAR PATCH PANELS

A. Install Modular Patch Panel(s) in a fashion as to allow future horizontal cabling to be terminated on the panel without disruption to existing connections.

B. Size Modular Patch Panels to accommodate a minimum of 20% growth in the quantity of equipment outlets relative to the initial installation.

C. Panel designs which feature removable modular jack assemblies may be partially populated.

D. All jack positions in a row shall be populated.

E. At Equipment Outlet and Modular Patch Panel, ensure that the twists in each horizontal cable pair are preserved per manufacturer's recommendations, typically to within 0.5-

inch of the termination. Remove the cable jacket only to the extent required to make the termination.

- F. Bond F/UTP cable shield and drain wire to connecting hardware per manufacturer's instructions. Bond connecting hardware to the Telecommunications grounding system.
- G. Provide horizontal cable management hardware above and below each Modular Patch Panel.
 - 1. Exception: Where angled patch panels are specified, provide horizontal management above and below patching area. In large installations, add management in the middle of the patching area. Refer to project drawings.

3.012 CABLE TERMINATION - FIBER OPTIC

- A. Provide Fiber Optic Patch Panels configured with connector adapters (couplings) adequate to accommodate the number of fibers to be terminated.
- B. Terminate optical fibers using the specified connector type.
- C. Mate terminated fibers to couplings mounted on patch panels. Adapters shall be mounted on a panel that, in turn, snaps into the housing assembly.
- D. Fit any unused panel positions with a blank panel which blocks access to the fiber optic cable from the front of the housing.
- E. Provide and organize couplers as follows:
 - 1. Fibers from multiple locations may share a common enclosure. They must, however, be segregated on the connector panels and clearly identified.
 - 2. Connectors from different location shall never share a common coupling panel.
 - 3. Segregate single mode and multi-mode (where applicable) optical fibers on the panels as to clearly identify the distinction between the fiber types.
 - 4. Install Duplex Adapters with polarity (e.g., keyway orientation) on each end opposite that of the other end (i.e., A-B, A-B... on one end and B-A, B-A... on the other). Polarity shall be per TIA-568 (referenced version). Refer to that standard for further detail.
 - a. Note: Factory screening of adapter panels sometimes complicates adapter panel layout. Confirm plan with engineer prior to construction.
 - 5. Position optical fibers consecutively and mapped "position for position" between patch panels. There shall be no transpositions in the cabling. "Reverse-pair positioning" is not allowed.

6. Fit all couplings with a dust cap.
- F. Provide slack in each fiber as to allow for future re-termination in the event of connector or fiber end-face damage. Adequate slack shall be retained to allow termination at a 30” high workbench positioned adjacent to the termination enclosure(s). A minimum of 1-meter (~39”) of slack shall be retained regardless of panel position relative to the potential work area.
- G. Where "Loose Buffered" cables are installed, use a manufactured "fan-out" kit whereby individual fibers are secured in a protective covering which extends from the buffer tube to the connector assembly.
- H. Clean all fibers once mated to adapters and protect with dust cap. Follow manufacturer’s recommendations for cleaning technique and products.
- I. Where fibers are to be left unterminated, prep all such fibers in a fashion as to facilitate future termination. Splice Tray. Label Blank Panels intended for initially unterminated fibers as “Future” and indicate fiber count.

3.013 IDENTIFICATION AND LABELING

- A. Label all Backbone and Horizontal Cable, Outlet Faceplates, and Termination components (e.g., Voice Termination Blocks & Modular Patch Panel).
- B. Prior to installation, provide samples of all label types planned for the project. These samples shall include examples of the lettering to be used.

3.014 TESTING AND ACCEPTANCE

A. GENERAL

1. Prior to testing, provide a Test Plan for each cable type including equipment (makes/models) to be used, set-up, pass/fail limits and results format. A sketch of each test set-up (hand-drawn is OK) and results report examples are encouraged.
2. The Test Plan shall consider the requirements identified below plus any manufacturer-required test, test method or reporting format needed to support the specified warranties.
3. Test results format should include proposed filenames and be organized by Cable Type, Subsystem (Horizontal or Backbone), Building and Equipment Room. Prefix filenames with the City project number.
4. Content of native format records should be organized to allow for interim records to be combined into the composite results package required at project closeout.

5. Failure to provide the above information shall be grounds for the Engineer and/or DFD to reject any and all Documentation of Results on related testing and to require a repeat of the affected test(s).
6. Visually inspect all cabling and termination points to ensure that they are complete and conform to the wiring pattern defined herein. Provide to the Engineer with a written certification that this inspection has been made.
7. Provide Test Plan as part of this notice or sooner.
8. Supply all equipment and personnel necessary to conduct the acceptance tests.
 - a. Test equipment and measurement methods shall comply with the standards referenced in PART 1.
 - b. All equipment used in testing shall be maintained and calibrated per manufacturer's guidelines. Provide documentation of equipment calibration.
9. Set Test Unit Limits to match specified performance requirements. For example, for Category 6 Horizontal Cabling, limits should be set to "Category 6 Permanent Link". Test limit for fiber optic cable should be set to consider cable length, connectors and, if applicable, splices as detailed in PART 2 and below.
10. Perform tests related to connected equipment by others only with the permission and presence of the agency and/or responsible contractor.
11. The AOR may request that a random field re-test—not to exceed 10% of the installed cabling—be conducted on the cable system to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the Contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. Any and all re-tests shall be at no additional cost to the project.
12. All cabling shall be 100% fault free. Should it be determined by the Engineer that the materials or any portion thereof furnished and installed under this contract fail to comply with the specifications and drawings with regard to quality, performance, value of materials, appliances or labor used in the work, it shall be rejected and replaced by the Contractor and all work disturbed by changes in consequence of said defects or imperfections made good at the Contractor expense.
13. Where the installation includes use of existing or agency-provided cabling and/or connectivity components, links that fail to meet the specified limits (e.g., Category 6) shall be evaluated by the contractor to determine the likely cause of the failure. Contractor shall propose a plan for corrective action to the DFD Construction Representative and Engineer for approval prior to any rework

and/or cable or component replacement. Such corrective actions and related retests will be considered additions to contractor scope.

B. COPPER BACKBONE CABLING

1. Verify cable as free of shorts within the pairs, for continuity, pair validity and polarity and for conductor position on termination hardware.
2. For pair counts exceeding 100-pair, a percentage of “bad” pairs not to exceed 3% in any cable shall be allowed. Identify and document all bad pairs.
3. Correct any mis-positioned pairs.

C. HORIZONTAL 4-PAIR COPPER CABLING

1. General
 - a. Test from the Equipment Outlet to the Modular Patch Panel (or Wiring Block) at the TR on which the cables are terminated.
 - b. Cables shall be installed and dressed at the patch panel and secured in the outlet box at the Equipment Outlet location with the faceplate in place.
 - c. The cabling must pass all the specified requirements. Conditional passing test results that are within the measurements accuracy of the test equipment (e.g., “*PASS”) are not acceptable.
 - d. When the EO is located on/in the wall behind modular furniture, a patch cord may be inserted into the EO to allow the furniture to be returned to its normal location. Cable testing, in this case, will be done with the patch cord. If the cable test fails only due to the length of the patch cord, the DFD will accept the cable as passing. Provide list of such locations in Test Results documentation.
 - e. Horizontal cables shall be free of shorts within the pairs, and be verified for continuity, pair validity and polarity, and Wire Map (Conductor Position on the Modular Jack).
 - f. Correct any defective, split or mis-positioned pairs.
 - g. Additional testing of Cabling Systems rated at TIA Category 5e and higher shall be performed to confirm proper functioning and performance.
2. Performance Testing
 - a. Test Performance per ANSI/TIA-568-C.2 Permanent Link test configuration and procedures.
 - b. Test using a test instrument designed for use with the installed cable type(s) and specified standards. The instrument shall verify “PASS” on

each cable and record the results of all tests, comparing measured values with standards-based limits.

- c. Test Transmission Performance of Horizontal Cabling to include the following:

- Length

- Attenuation (Insertion Loss)

- Pair-to-Pair NEXT Loss

- PSNEXT Loss

- Attenuation-to-Crosstalk Ratio (ACR)

- Power-sum ACR (PSACR)

- Propagation Delay

- Delay Skew

- Return Loss

- DC Loop Resistance

- ANSI/TIA-1152 Optional++ Tests including:

- Transverse Conversion Loss (TCL)

- Equal Level Transverse Conversion Transfer Loss (ELTCTL)

- DC Resistance Imbalance (in-pair & pair-to-pair)

- d. The maximum length of horizontal cable Permanent Link shall not exceed 90 meters (295 feet).
- e. Program test unit to match Net Propagation Velocity (NPV) of the installed cable type.
- f. In the event results of the tests are not satisfactory, make changes as necessary and repeat the test or tests which disclosed faulty or defective material, equipment or installation method.

3. Special Considerations
 - a. Where Cabling is terminated in a Modular Plug at the device location (e.g., Video Surveillance Camera or Wireless Access Point), test per standards for a Modular Plug Terminated Link (MPTL)..
 - b. Where the horizontal cabling includes an interconnect (e.g., where a zone cable is extended from a Consolidation Point to the work area Equipment Outlet (EO)), testing of the Permanent Link shall be from the Horizontal Cross-connect at the Telecom Room to the EO and include the interconnect.
 - c. Where a Surge Protector is in place as part of the Horizontal Permanent Link, performance testing shall include the Surge Protector as part of the link.
 - d. Where F/UTP cabling is installed, testing shall include Shield Continuity.

4. Voice Channel Test
 - a. Where cross-connection of Horizontal & Backbone cable is contractor responsibility:
 - 1) Test each subsystem separately.
 - 2) Test the completed "Channel" after cross-connect wiring/patching is complete.
 - b. Voice Channel Test confirms the end-to-end voice transmission between the Main Cross-connect and the Equipment Outlet (Voice).
 - c. Test all pairs to be free of shorts and verify for continuity, pair validity, polarity, and conductor position.
 - d. Correct any mis-positioned pairs or cross-connect wiring. Replace any patch cords/jumper cables which cause the Voice Channel test to fail and retest Channel.
 - e. Performance testing on the Voice Channel is not required.

D. FIBER OPTIC CABLE

1. General
 - a. The fibers utilized in the installed cable shall be traceable to the manufacturer. Upon request by the Owner, provide cable manufacturer's test report for each reel of cable provided. These test reports shall include:
 - 1) Manufacturer's on the reel attenuation test results at the specified wavelengths for each optical fiber of each reel prior to shipment from the manufacturer.
 - 2) On-the-reel Bandwidth performance as tested at the factory.

E. Tests Prior to Installation

1. At Contractor discretion and at no additional cost to the project, contractor may perform tests s/he considers necessary to ensure integrity of any cable to be installed. Upon request, supply this test data to the Engineer prior to installation.

F. Tests After Installation

1. Upon completion of cable installation and termination, test Fiber Optic cabling to include:
 - a. Optical Attenuation
 - b. Verification of Link Integrity and component losses

G. Optical Attenuation Testing

1. Measure Optical Attenuation on all terminated optical fibers in at least one direction of transmission. Measurement shall be inclusive of the optical connectors and couplings installed at the system endpoints.
2. Test using one of the following methods:
 - a. Insertion Loss method using an Optical Loss Test Set (OLTS) or an OTDR which integrates an Attenuation Measurement function.
 - b. OTDR method must record the combined loss of the optical fiber and connectors at both ends of the link. Configure OTDR set-up to match project specifications.
3. Where Insertion Loss method is used:
 - a. Test multimode fibers in accordance with TIA-568 and -526-14 (Method B; one jumper reference) at 850 and 1310 nm (nominal).
 - b. Test single-mode fibers in accordance with TIA-568 and -526-7 (Method A.1; one jumper reference) at 1310 nm (nominal) and 1550 nm.
4. Attenuation of optical fibers shall not exceed the values calculated as follows:
 - a. Multimode fiber where cable length \leq 300-meters and includes no splices – 2.5 dB
 - b. Single-mode fiber where cable length \leq 300-meters and includes no splices – 1.8 Db
 - c. Cable $>$ 300-meters or any cable containing splices – $2*C+(L*F)+S$

Where:

C = maximum allowable Connector Loss

L = length of the run

F = maximum allowable fiber loss per unit length (e.g., dB/kf.

S = total splice loss (# of splices * max. attenuation per splice; Do not count the “pigtail” splice.).

d. Where an OTDR is used to measure attenuation, use of the bi-directional test (average) is acceptable.

H. OTDR Testing

1. Document all fibers – even those that are left un-terminated (if applicable) – in both directions of transmission using an Optical Time Domain Reflectometer (OTDR).
2. Test multimode fibers at 850 and 1310 nm (nominal).
3. Test single-mode fibers at 1310 nm (nominal) and 1550 nm.
4. OTDR(s) used in testing shall incorporate high-resolution optics optimized for viewing of short cable sections. Set Pulse Width to shortest width usable and still obtain clean trace.
5. Use jumpers of adequate length at both ends of cable under test to allow viewing and accurate measurement of the entire link – including cable and connectors at the launch and tail end.
6. OTDR traces revealing a point discontinuity greater than 0.2 dB in a multi-mode fiber, or 0.1 dB in a single mode fiber at any of the tested wavelengths or any discontinuity showing a reflection at that point shall be a basis for rejection of that fiber by the Owner. The installation of that cable shall be reviewed in an effort to remove any external stress that may be causing the fault. If such efforts do not remove the fault, that cable and the associated terminations shall be replaced at the expense of the contractor.
7. Submitted traces should document connector Reflectance performance as meeting the specified criteria for the connector type(s) installed.

I. COAXIAL CABLE TESTING

1. Test coaxial cables to:
 - Locate Breaks, Faults or flawed terminations.
 - Verify Length.
 - Verify Impedance (to within 5% of nominal value).
 - Verify Return Loss (5-MHz to 1-GHz).
2. Terminate cable – as required by individual tests – with its characteristic impedance.

3.015 DOCUMENTATION

A. GENERAL

1. Provide project documentation as detailed in the sub-sections below.
2. Submit all documentation in electronic form.
3. In addition, provide [(1)][(2)] paper copies of Record Drawings.
4. Where documentation provided in electronic form requires unique software (e.g., NATIVE formats) other than Adobe Acrobat Reader for viewing test results, provide one (1) copy of such software. The software shall run on MICROSOFT *Windows operating system*. Software shall include license if applicable.
5. Organize documentation by Building, Telecom Room and cable type.
6. Name file(s) and records to include building, route or other cable identifiers that match labeling formats used. Prefix file name with the City project number.
7. Provide test results and describe the conduct of the tests including the date of the tests, the equipment used, and the procedures followed. At the request of the AOR, provide copies of the original test results.
8. Where interim documentation has been submitted, submit a composite results package containing all records at project closeout.
9. Where the installation includes re-use of existing cabling and/or components, documentation shall include a summary of such materials including manufacturer/part and where used.

B. TEST DATA - COPPER MEDIA

1. Test results shall include a record of test frequencies, cable type, conductor pair and cable I.D. (see 27 05 53), measurement direction, test equipment type, model and serial number, calibration date, test date, reference setup, and crew member name(s).
2. Submit Test Results for each Horizontal Link and each Backbone Cable in electronic form as follows:
 - a. In the native format of the test instrument (e.g., flw for Fluke, .sdf for Agilent or Ideal, etc.).
 - b. Summarized in a fashion that includes a graphical display of key test parameters. The Summary shall be in Adobe Acrobat (.pdf) format and

include all records. Individual .pdf documentation of individual records (e.g., for each horizontal cable) are not required.

c. Summary should display Margins (Headroom) for each cable.

3. Individual records for Horizontal Cabling shall identify Outlet ID using a consistent format for all records to allow for sorting.

C. Cross-Connect Data

1. Where applicable, provide assistance to allow Owner and/or Internet/Telephone Service Provider personnel to make the necessary connections to establish and/or maintain service on the new cable system. These activities include but are not limited to (1) a general wiring overview and (2) detailed cross-connect documentation (relating EO I.D., Room Number and Riser pair). The latter shall be in the form of an electronic format database (MS Excel or convertible format). An example Template is available from the DFD.

D. TEST DATA - FIBER OPTIC MEDIA

1. Test results shall include a record of test wavelengths, cable type, cable and fiber I.D., measurement direction, test equipment type, model and serial number, calibration date, test date, reference setup, and crew member name(s).

2. Use United States customary units (e.g., “feet”) rather than International System units (SI; metric) unless otherwise instructed.

3. Submit Attenuation (Insertion Loss) Test Results for each fiber in electronic form as follows:

a. In the native format of the test instrument.

b. Summarized to include a list of all fibers and the corresponding attenuation values. The Summary shall be in Adobe Acrobat (.pdf) format and include all records.

4. Attenuation values documents should be actual measured Loss and not “Headroom” relative to the Pass/Fail limit.

5. Submit OTDR in electronic form in the native format of the test instrument.

6. Document connector end-face condition per IEC 61300-3-35 (inter-building backbone cabling only).

E. RECORD DRAWINGS

1. Provide Record Drawings which denote as-built information.
2. Include cable routes and outlet locations.
3. Identify Telecommunications and other low-voltage Outlet locations by their sequential number as defined elsewhere in these documents. Numbering, icons and drawing conventions used shall be consistent throughout all documentation provided.
4. Identify each drawing submitted by the Contractor as part of the Project Documentation as a "Record Drawing" (RD) and include a) the contractor name and/or logo, and b) the date of the drawing.
5. Retain all fonts, color, layer, Model Space/Paper Space conventions established in the base drawings by the Contractor in preparation of the As-built drawings.
6. Prior to generation of the drawings, provide a sample file to the Engineer for review and approval.
7. All documentation, including hard copy and electronic forms shall become the property of the State.

3.016 TRAINING

- A. Provide training covering the installed system to City Staff, and/or contract maintenance personnel.
- B. Training to include:
 - Overview of System Topology and General Concepts
 - Overview of Products Used
 - Overview of Labeling Formats
 - Overview of Test Results and their meaning
 - Overview of Documentation (Record Documents, O&M Manuals)
- C. Other project team members may, at their discretion, participate in the session as a presenter.
- D. City reserves the right to record session(s) for use as future refresher materials for Agency technical staff.

3.017 WARRANTY

- A. See division 1, general conditions, and general requirements - guarantee documents for general requirements.
- B. Where all materials are contractor-provided, minimum warranty period for structured cable system sub-systems shall be as follows:
 - 1. Horizontal copper permanent link – 15 years. Warranty shall be direct from manufacturer(s) of cabling and connecting components to owner.
 - 2. Exception: where cabling is terminated in a modular plug, such links shall be covered by a 2-year system warranty. Cabling and connecting components shall carry a 15-year manufacturer's component warranty.
 - 3. Copper backbone – 2 years.
 - 4. Fiber optic backbone – 2 years. Cabling and connecting components shall carry a 15-year manufacturer's component warranty.
- C. Warranties shall include all labor, material, and travel time.
- D. Where the project includes re-use of existing cabling and/or components or installation of agency-furnished materials, contractor warranty shall be per Division 1 and cover contractor-provided materials. Cable and connecting component warranties shall be as indicated above.
- E. Provide Warranty Certification of the Horizontal Copper Permanent Link from the manufacturer(s) of cabling and connecting components as part of system documentation.
- F. Submit documents to manufacturer as required for Extended Warranties.

END OF SECTION

APPENDIX 1 – ACRONYMS

ANSI	American National Standards Institute
BICSI	Building Industry Consulting Services, International
CESM	Compact Edge Switch-Managed
CLDF	Classroom Local Distribution Frame
EIA	Electronic Industries Alliance
ESM	Edge Switch-Managed
FEP	Fluorinated Ethylene Propylene
HVAC	Heating, Ventilation, and Air Conditioning
IDF	Intermediate Distribution Frame
IEC	International Electrotechnical Commission (IP Code)
IEEE	Institute of Electrical and Electronic Engineers
IP32	Degree of Ingress Protection Provided by Enclosures (IEC)
IP	Internet Protocol
IPX	Inter-network Packet Exchange
ISA	Industry Standard Architecture
ISDN	Integrated Services Digital Network
ISM	Intermediate Switch-Managed
ISP	Internet Service Provider
ITD	LAUSD, Information Technology Division
LAN	Local Area Network
LAUSD	Los Angeles Unified School District
LDF	Local Distribution Frame
LIU	Light Interconnection Unit
MDF	Main Distribution Frame
MDF-BBS	Main Distribution Frame Backbone Switch
MPOE	Minimum Point of Entry
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
OAR	Owner Authorized Representative
OFNR	Optical Fiber Non-Conductive Riser
OTDR	Optical Time Domain Reflectometer.
PA	Public Address
TIA	Telecommunications Industry Association
UL	Underwriters Laboratories Inc.
UTP	Unshielded Twisted Pair
WAN	Wide Area Network

END OF APPENDIX 1

APPENDIX 2 – DEFINITIONS

BBS	The Backbone Switch that serves as the central point of network termination, and provides network connectivity to IDFs, computer labs, student nutritional service areas, and libraries.
ISM	The Intermediate Switch-Managed serving as the network termination point for horizontal cabling to classrooms and other areas excluding computer labs and libraries.
ESM	The Edge Switch-Managed serving as the network termination point for horizontal cabling within computer labs, student nutritional service areas, and libraries.
CESM	The Compact Edge Switch-Managed and is a small form factor network access point within the classroom or other designated area for network connections.
MDF	The structure that serves as an entrance facility or main cross-connect, serving the building or campus.
IDF	Located between the MDF and the LDFs and provides a network access point for horizontal fiber cabling.
LDF	A wall-mounted cabinet that serves as the termination point for Category 5E cabling within the room/area in a computer lab, student nutritional service area, or library.

END OF APPENDIX 2

APPENDIX 3 – CABLE RECORD DOCUMENT

Cable Installation Record

Page: # of #

Project Name:

Date Work Completed:

Installation Contractor:

Inspected by:

Cable									Strand/Pair			Termination
#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	Room Number
T	C	0	0	1	0	0	1	-	0	0	1	
								-	0	0	2	
								-	0	0	3	
								-	0	0	4	
								-	0	0	5	
								-	0	0	6	
								-	0	0	7	
								-	0	0	8	
								-	0	0	9	
								-	0	1	0	
								-	0	1	1	
								-	0	1	2	
								-	0	1	3	
								-	0	1	4	
								-	0	1	5	
								-	0	1	6	
								-	0	1	7	
								-	0	1	8	
								-	0	1	9	
								-	0	2	0	
								-	0	2	1	
								-	0	2	2	
								-	0	2	3	
								-	0	2	4	
								-	0	2	5	
T	C	0	0	1	0	0	2	-	0	0	1	
								-	0	0	2	
								-	0	0	3	
								-	0	0	4	
								-	0	0	5	
								-	0	0	6	
								-	0	0	7	
								-	0	0	8	
								-			•	
								-			•	
SAMPLE ONLY												

LAUSD - Cable Record (Revision 1b - 06/01/06)

END OF APPENDIX 3

SECTION 32 1313 - SITE CONCRETE WORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: On-site concrete work:

1. Portland cement concrete pavement, driveways, curbs, gutters and mowing strips.
2. Ramps and stairs on grade.
3. Pipe encasements, thrust blocks, and equipment pads.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 03 1000 – Concrete Forming and Accessories.
3. Section 03 2000 - Concrete Reinforcement.
4. Section 03 3000 – Cast-in-Place Concrete.
5. Division 23 - HVAC.
6. Division 26 - Electrical.
7. Section 32 3113 - Chain Link Fences and Gates.

+1.02 REFERENCES

A. Structural work, such as retaining walls, planter walls, cast-in-place benches, equipment pads, and footings for playground equipment, fences, walls, shade structures and flagpoles shall conform to the following Sections:

1. Section 03 1000 Concrete Forming.
2. Section 03 2000 Concrete Reinforcing.
3. Section 03 3000 Cast-in-Place Concrete.

B. Flatwork, such as walkways, driveways, ramps and steps on grade, swales, curbs, mow strips and utility related concrete, conform to:

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1. Standard Specifications for Public Works Construction, The “Greenbook”, except reclaimed aggregates and processed miscellaneous base are not allowed.
- C. Imported or exported earthwork shall conform to Section 01 4524 Environmental Import / Export Materials Testing.
- D. National Ready Mixed Concrete Association (NRMCA):
 1. Checklist for the Concrete Pre-Construction Conference.

1.03 QUALITY ASSURANCE

- A. Source Limitations for Exposed Concrete: Obtain each color, size, type, and variety of concrete material and concrete mixture from single manufacturer with resources to provide concrete of consistent quality in appearance and physical properties. Secure material required for the duration of the project as needed to ensure consistent quality in appearance.
- B. Pre-Installation Conference:
 1. CONTRACTOR shall coordinate and conduct pre-installation conference in conformance to Section 01 3119 Project Meetings.
 2. CONTRACTOR shall use the NRMCA “Checklist for the Concrete Pre-Construction Conference” as the meeting agenda.
- C. Mockup:
 1. Build 8 feet by 8 feet mockups of full-thickness sections of concrete paving using processes and techniques intended for use on permanent work, including curing procedures.
 2. Build mockups to demonstrate typical joints; surface finishes and standard of workmanship.
 3. Obtain ARCHITECT’s approval of mockup before proceeding with work of this Section.
 4. Mockup shall remain through completion of the work for use as a quality standard for finished work.
 5. Remove mockup when directed by the OAR.
- D. Field applied primers, paintings, sealers, sealants, caulking, leveling and patching compounds, crack/joint repair compounds adhesives and similar products shall be approved by the OWNER’s Office of Environmental Health and Safety (OEHS).

1.04 SUBMITTALS

- A. Structural Work: Conform to the applicable requirements of Sections 03 1000 Concrete Forming, 03 2000 Concrete Reinforcing and 03 3000 Cast-in-Place Concrete.

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- B. Flatwork: Submit mix design in conformance to the Greenbook.
- C. Shop Drawings: Submit drawings indicating the locations of concrete joints, including construction joints, expansion joints, isolation joints, and contraction joints.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Store cement and aggregate materials so to prevent their deterioration or intrusion by foreign matter. Deteriorated or contaminated materials shall not be furnished.
- B. Packaged materials shall bear the manufacturers and brand name label and shall be stored in their original unbroken package in a weather tight place until ready for use in the work.
- C. Avoid exposure of reinforcing steel bars, wire, and wire fabric to dirt, moisture or conditions harmful to reinforcing.
- D. Reinforcing steel bars, wire, and wire fabric shall be stored on the Project site to permit easy access for examination and identification of each shipment. Material of each shipment shall be separated by size and shape.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Structural Work: Conform to the applicable requirements of the following Sections, except as otherwise specified:
 - 1. Section 03 1000 Concrete Forming.
 - 2. Section 03 2000 Concrete Reinforcing.
 - 3. Section 03 3000 Cast-in-Place Concrete.
- B. Flatwork: Conform to the applicable requirements of the Greenbook, Section 201, except as follows:
 - 1. Water/cement ration for concrete flatwork shall be 0.50 maximum.
 - 2. Base course shall conform to Section 32 3226 Base Course.
 - 3. Reclaimed concrete material shall not be used.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that gradients and elevations of base are correct. Maintain subgrade clean and in a smooth, compacted condition until the concrete is placed.

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- B. Maintain subgrade in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. Earth surface shall be kept moist by frequent sprinkling up to the time of placing concrete.

3.02 CONSTRUCTION OF FORMS

- A. Flatwork Forming: Set forms to the indicated alignment, grade and dimensions. Hold forms rigidly in place by a minimum of 4 stakes per form placed at intervals not to exceed two feet. Use additional stakes and braces at corners, deep sections, and radius bends, as required. Use clamps, spreaders, and braces where required to ensure rigidity in the forms.
- B. Wall Formwork: Forms shall be constructed to conform to final concrete shape, lines and dimensions of members required by Drawings and Specifications. Forms shall be sufficiently tight to prevent leakage of concrete and properly braced or tied together to maintain position and shape.

3.03 STEEL REINFORCEMENT INSTALLATION

- A. Fabricate bars of the indicated sizes and bend and form to required shapes and lengths by methods not injurious to materials. Do not heat reinforcement for bending. Bend bars No. 6 size and larger in the shop only. Bars with unscheduled kinks or bends are not permitted.
- B. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- C. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces, and lace splices with wire.
- D. Clean reinforcement of loose rust and mill scale, earth, or bond-reducing materials.

3.04 PREPARATION FOR CONCRETE PLACEMENT

- A. Surfaces to receive concrete shall be free of debris, standing water, and any other deleterious substances before start of concrete placing.
- B. Do not place concrete until forms, reinforcement, pipe, conduits, outlet boxes, anchors, sleeves, bolts, and other embedded materials are securely fastened in place. Maintain a minimum of two inches clearance between said items and any part of the concrete reinforcement.
- C. Adjust pull boxes, meter boxes, valve covers and manholes to proposed finish grade prior to placement of concrete. Anchor bolts shall be accurately set and maintained in position by templates while being embedded in concrete.
- D. Clean thoroughly the surfaces of metalwork to be in contact with concrete, remove dirt, grease, loose scale and rust, grout, mortar, and other foreign substances before the concrete is placed.
- E. Moisten subbase to provide a uniform dampened condition at time concrete is placed.

3.05 CONCRETE PLACEMENT

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- A. Place, compact, screed, float and trowel concrete as indicated in Section 03 3000 Cast-in-Place Concrete.
- B. Finish: After straightedging, when most of the water sheen has disappeared and just before the concrete hardens, finish the surface with a wood or magnesium float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. Produce a scored surface by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, followed by edging.
 - 1. Provide medium broom finish on surfaces up to six percent slope by striating surface 1/32 to 3/64 inch deep with a soft bristle broom across concrete surface to provide a uniform fine line texture.
 - 2. Provide heavy broom finish on surfaces over six percent by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom.

3.06 JOINTS

- A. Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated. Align curb, gutter, and sidewalk joints.
- B. Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour.
 - 1. Continue steel reinforcement across construction joints unless otherwise indicated on the Drawings.
 - 2. Provide tie bars at sides of paving strips where indicated on the Drawings
 - 3. Butt Joints: Use bonding agent or epoxy-bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
 - 5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated on the Drawings.
- D. Expansion Joints:
 - 1. Provide premolded joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together. Extend expansion joint fillers full-width and depth of joint, and 1/4" below finished surface where joint filler is indicated. If no joint sealer is indicated place top of premolded joint filler flush with top of concrete or curb.

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2. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- E. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints to a depth equal to at least one-fourth of the concrete thickness, as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Remove grooving-tool marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- F. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Remove edging-tool marks on concrete surfaces.
- G. Where concrete is to be cast against old concrete, (greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by sand- blasting, exposing the aggregate. The hardened surface shall be cleaned of latent foreign material and washed clean, prior to the application of an epoxy bonding agent.

3.07 STAIRS AND RAMPS

- A. Install support post sleeves into the perimeter concrete curbing during the installation process of the curbing. Sleeves shall be three-inch diameter, schedule 40 PVC with a cap solvent welded to the bottom of the sleeve. Drill a half-inch weep hole on the bottom of the cap. Sleeve and cap shall be Nibco products or approved equal. Sleeves shall be embedded into concrete a minimum of nine inches and spaced at a maximum of four feet, or as indicated on the Drawings. Fill sleeve with non-shrink grout Quickcrete #1585-01 when setting posts. Provide control joints into the concrete on both sides for each post.
- B. Finish step nosings with a safety step edger/groover with a 1/2 inch radius and four grooves spaced equally 3/4 inch on center and a bit depth between 1/4 to 3/8 inch. Paint with contrasting color.

3.08 CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING

- A. Formed Curb and Gutter: Place concrete to the required section in a single lift. Consolidate concrete using approved mechanical vibrators. Finish curve shaped gutters with a standard curb mule or concrete slipformed curb paving equipment.

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- B. Concrete Finishing: Float and finish exposed surfaces with a smooth wood float until true to grade and section and uniform in texture. Brush floated surfaces with a fine- hair brush using longitudinal strokes. Round the edges of the gutter and top of the curb with an edging tool to a radius of 1/2 inch. Immediately after removing the front curb form, rub the face of the curb with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. Brush the front curb surface, while still wet, in the same manner as the gutter and curb top. Finish the top surface of gutter to grade with a wood float.
- C. Surface and Thickness Tolerances: Finished surfaces shall not vary more than 1/4 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

3.09 CLEAN UP

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project Site.

3.10 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 32 3113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Chain link fences and gates as indicated.
- B. Related Requirements:
 - 1. Division 01 - General Requirements.
 - 2. Section 03 3000_ - Cast-in-Place Concrete.
 - 3. Section 32 1313 - Site Concrete Work.

1.02 SUBMITTALS

- A. Shop Drawings: Submit dimensioned plans and details indicating extent of fences, locations of gates, and details of attachment and footings. Indicate means and methods for surface preparation and finishing.
- B. Certifications: Manufacturers material certifications in compliance with the ASTM standards referenced in this Section.

1.03 REFERENCES

- A. ASTM A392: Standard Specification for Zinc-Coated Steel Chain Link Fence Fabric.
- B. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- C. ASTM A824 – Standard Specification for Metallic-Coated Steel Marcellled Tension Wire for Use with Chain Link Fence.
- D. ASTM F552 - Standard Terminology Relating to Chain Link Fencing.
- E. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- F. ASTM F567: Standard Practice for Installation of Chain Link Fence.
- G. ASTM F626 - Standard Specification for Fence Fittings.

- H. ASTM F668 - Standard Specification for Polyvinyl Chloride (PVC), Polyolefin and Other Polymer-Coated Steel Chain Link Fence Fabric.
- I. ASTM F900 - Standard Specification for Industrial and Commercial Swing Gates.
- J. ASTM F934 - Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials.
- K. ASTM F1083: Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
- L. ASTM F1184: Standard Specification for Industrial and Commercial Horizontal Slide Gates.
- M. ASTM F1664 – Standard Specification for Poly Vinyl Chloride (PVC) and Other Conforming Organic Polymer-Coated Steel Tension Wire Used with Chain-Link Fence.
- N. ASTM F2200 - Standard Specification for Automated Vehicular Gate Construction.
- O. UL 325 - UL Standard for Safety Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.04 QUALITY ASSURANCE

- A. Manufacturer: Company specialized in manufacturing chain link fence products with at least five years of experience.
- B. Fence Installer: Company with demonstrated successful experience installing similar projects and products in accordance with ASTM F567 and with at least five year experience.

PART 2 – PRODUCTS

2.01 CHAIN LINK FABRIC

- A. Galvanized Chain Link Fabric: Conforming to ASTM A392, Class 2 zinc coating, 2.00 ounces minimum per square foot of uncoated wire surface, hot-dipped galvanized after weaving, and with top and bottom edges knuckled (kk). Tie wires and hog rings shall conform to ASTM F626, and shall be 9 gage and galvanized.
- B. Chain Link Fabric Requirements:
 - 1. Fabric for perimeter fencing and interior fencing shall be 9 gage woven wire with 2 inch mesh, unless otherwise specified.
 - 2. For perimeter fences 16 feet high, the upper 8 feet of fabric may be 11 gage.
 - 3. Fences 12 feet high or less shall be furnished with single width fabric.

4. Fabric for fencing on top of handball court shall be 9 gage wire minimum with 1 inch mesh.
5. Fabric for fencing of tennis courts shall be full height, single width, 9 gage by 1-3/4 inches mesh chain link fabric.
6. Installed fence fabric shall be free from barbs, icicles, or other projections. Fence fabric with such defects will be deemed defective Work.

2.02

STEEL FENCE FRAMEWORK

- A. Posts, Top Rails, Brace Rails and Gate Frames: Standard weight, galvanized, welded steel pipe conforming to ASTM F1083, Group IA Heavy Industrial Fence Framework, with a minimum yield strength of 30,000 psi. Minimum 1.8 Oz/ft² hot dipped zinc coating average for interior and exterior.
- B. Schedule of Posts, Rails, Bracings and Footings: Unless indicated otherwise on the drawings, shall be of sizes indicated on the following schedule.

Item	Height	Nominal Pipe Size (inches)	Outside Diameter (inches)	Weight (pounds per foot)	Footings	
					Diameter (inches)	Depth (inches)
Top Rail, Brace Rails and Transom Rails	Up to 10'-0"	1-5/8	1.660	2.27	N/A	N/A
	10'-1" to 16'-0"	1-7/8	1.900	2.72	N/A	N/A
Line Posts	Up to 6'-0"	2-3/8	2.375	3.65	12	24
	6'-1" to 8'-0"	2-3/8	2.375	3.65	12	36
	8'-1" to 10'-0"	2-7/8	2.875	5.80	12	36
	10'-0" to 16'-0"	3-1/2	3.5	7.58	14	60
	14'-0" to 16'-0"	4	4.000	9.12	14	60
Terminal, Corner, Angle & Pull Posts	Up to 8'-0"	2-1/2	2.875	5.79	12	36
	8'-0" to 10'-0"	2-1/2	2.875	5.79	14	42
	10'-1" to 16'-0"	3	3.5	7.58	14	60
Pedestrian Gate Posts	Up to 8'-0"	2-1/2	2.875	5.79	14	36
Gate Frames	Up to 8'-0"	1-1/2	1.900	2.72	N/A	N/A
Driveway Double-Leaf Swing Gate Posts: Opening						
Up to 17'-3-1/2"	Up to 8'-0"	3 1/2	4	9.11	16	42
17'-4" to 20'-3-1/2"	Up to 8'-0"	3-1/2	4	9.11	16	42

2.03

FITTINGS

- A. Fittings shall be malleable iron conforming to ASTM F626.
- B. Post Caps: Designed to fit snugly over posts with a minimum projection of 1-1/2 inches below top of posts. Post caps shall be manufactured with a curved top.
- C. Eye Tops: Designed to fit over line posts, and for through passage of top rail.
- D. Expansion Sleeve Couplings for Top Rails: Steel, 6 inches long, designed to fit tightly on inside of rail, fitted with raised center.
- E. Rail Ends for Top Rails and Brace Rails: With holes to receive 3/8 inch bolts for securing to rail end bands.
- F. Tension Bands and Bands for Securing Rail Ends: Mild steel flats, at least 11 gage x one inch, tension bands in gates shall be 11 gage by 1 inch. Bolts for use with tension bands and rail end bands shall be galvanized machined 3/8 inch by 1 1/2-inch.
- G. Tension Bars: Mild steel flats at least 3/16 inch by 3/4 inch.

2.04 TENSION WIRE

- A. 6 gage marcelled steel wire conforming to ASTM A824, Type II Class 5 zinc coated, 2.00 ounces minimum per square foot of uncoated wire surface. Wavy type wire is not acceptable.
- B. Turnbuckles for installation with Tension Wires: Eye and hook type, drop forged steel, right and left hand threads, at least 3/8 inch screw diameter with at least 4 1/2-inches of take-up.

2.05 PAINT FOR GALVANIZING REPAIR

- A. Paints for Refurbishing Galvanizing: Organic zinc-rich paint conforming to ASTM A780. Paints used on the site shall be approved by OWNER's Office of Environmental health and Safety (OEHS).

2.06 GROUT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications "Rapid set Cement".

2.07 GATES

- A. General:
 - 1. Gate framework shall be fabricated of tubular steel of sizes indicated on the drawings and conforming to ASTM F1083, Group IA, with a minimum yield

strength of 30,000 psi. Joints at corners shall be miter cut and continuously welded to sides.

2. Latches and Hinges: Weld gate latches and strikes to gate posts and frames. Weld OWNER provided hinges to posts. Weld 3 hinges on each post for swing gates more than 16 feet wide. Welding shall be performed before gate frames are galvanized, or welds shall be finished as specified below.
 3. Grind welds flush and smooth. Hot-dip galvanize fabricated parts after welding, or be protected by zinc-rich paint in conformance to ASTM A780.
 4. Electrically operated gates shall be manufactured and installed in accordance with the safety requirements of ASTM F2200 and UL325.
- B. Swing Gates: Galvanized steel welded fabrication in conformance with ASTM F900, fabric size and gage shall match fence. Positive locking gate latch shall be fabricated of 5/16 inch thick by 1 3/4 inch pressed steel galvanized after fabrication.

2.09 CONCRETE

- A. Comply with requirements of Section 03 3000, Cast-in-Place Concrete. Provide normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3,000 psi, 4-inch slump, and one inch maximum size aggregate.

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Refer to the following Sections for earthwork related work:
1. Section 32 1313 - Site Concrete Work.

3.02 FRAMEWORK INSTALLATION

- A. Install fences as indicated on Drawings.
- B. Space fence posts at equal intervals between terminal, angle, corner, and gate posts, and not more than 10 feet apart measured from center to center of posts. In curved fence sections having a radius of 50 feet or less, space posts not more than 5 feet - 6 inches apart. Install posts so that top of eye of post caps are level with top of fabric.
- C. Install angle or corner posts at each change in direction of 15 degrees or more, at change of 5 percent or more in grade of fencing, and at the beginning and end of curved fence sections.
- D. Install terminal posts at ends of runs of fencing. Install gateposts on both sides of driveway and pedestrian gates. For double-leaf gates, net opening between gate posts

shall be gate size as indicated on Drawings, plus 3 ½-inches; for single leaf gates, net opening shall be gate size plus 2 ½-inches.

- E. Embed posts into footing 6 inches less than the depth of the footing unless noted otherwise on drawings.
- F. Where a fence is to be installed on a curb, construct footings with top of footing level with the lower finish grade. Align posts, set plumb and true before placing footings. Remove splattered concrete from exposed pipe surfaces while concrete is still soft. In bituminous surfaced areas, install seal coat on top of concrete footings.
- G. Install fences with top rail. Top rail shall pass through eye tops and be secured at ends with rail-end fittings and bands.
- H. Install fences over 10 feet in height, in addition to top rail, with a full length horizontal mid-rail set at mid-height of fence and rigidly secured to posts with rail end fittings and bands.
- I. In fences higher than 10 feet, install brace rails at angles, corners, and terminals at 1/4 and 3/4 of fence height. Provide one horizontal brace rail in panels adjacent to terminal, angle, corner, and gateposts, install at mid-height of fence and rigidly secured to posts with rail end fittings and bands. Provide horizontal brace rails, as specified, in panels of curved sections having a radius of 50 feet or less. Brace rails are not required in fencing 4 feet or less in height.
- J. Provide a transom rail and fabric at top of pedestrian gate openings. Install transom rail 6 feet 8 inches above high point of grade at gate opening. Ends of transom rails shall be pinned or riveted to rail end fittings with 1/4 inch mild steel rivets. Pin or rivet shall go through rail and peen. Welding on rail ends is not permitted.
- K. Install bottom tension wire a minimum of 3 inches from grade for fencing and secure to fence posts with ties. Provide a turnbuckle for each 150 feet of wire or fractional part thereof. Turnbuckles are not required in runs of 15 feet or less. Install ends of tension wires to posts in a manner to prevent slipping or loss of tension. Wrap should start from fence side of post. Turn end of wire around post tightly twisted at least three times around wire. At turnbuckles, wire through eye and tightly twist end at least three times around wire. Cut tail of bottom wire flush.

3.03 CHAIN LINK FABRIC INSTALLATION

- A. Install fence fabric on outward facing side of posts, except for tennis courts. Install fence fabric with top edge projecting above top rail of fence.
- B. Install bottom of fence fabric to clear finish grades, except on bituminous surface install 3/4 inch above such surface. Locally shape and trench ground surfaces where necessary to provide uniform top and bottom alignment of fence.

- C. Tightly stretch fabric and at terminal, pull corner, angle, and gateposts, secure with tension bars extending full height of fence. Secure tension bars to posts with bolted tension bands spaced not more than 14 inches apart.
- D. Bands and Ties: Install bands and ties in accordance with following schedule:

15 bands on 16 feet fence	16 ties on 16 feet fence
11 bands on 12 feet fence	12 ties on 12 feet fence
7 bands on 8 feet fence	7 ties on 8 feet fence
6 bands on 6 feet fence	6 ties on 6 feet fence
4 bands on 4 feet fence	4 ties on 4 feet fence
- E. Fasten fabric to line posts with wire ties spaced not more than 16 inches apart. Where 6 gage aluminum ties are furnished, hook the tie at both ends. Installation of hooked ties with links is not permitted.
- F. Fasten fabric to top rails, mid-rails, brace rails, with wire ties spaced not more than 18 inches apart. Bend back ends of tie wires so as not to be a hazard. At bottom tension wire, install hog rings spaced not more than 18 inches apart. Where 2 fabrics are furnished, lap the fabrics one mesh at mid-rail and tie both fabrics with 9 gage wire or 6 gage aluminum ties to midrails.

3.04 WELD GRINDING

- A. Grind all field welds smooth, clean off flux and spatter, damaged galvanizing removed, burrs and projections ground off, properly prepared, then heavily coated with galvanizing repair coating. Install coating in accordance with written recommendations of manufacturer.

3.05 3.06 INSTALLATION ON TOP OF CONCRETE WALLS

- A. Posts for fences on top of new concrete or concrete masonry walls shall be installed in 24 gage galvanized iron inserts one inch larger than the outside post diameter. Wall thickness for such installation shall be 8 inches minimum. Depth of embedment of post shall not be less than 15 inches for fence height not exceeding 4 feet. Install post plumb, true, and fill joint space with non-shrink grout, finished flush with top of wall. Remove excess grout and clean posts.
- B. Fencing on Gravity Walls: Post of fence not exceeding 8 feet high shall have a minimum of 15 inches embedment in gravity walls with a top width of 10 inches minimum and side of 1H: 4V. Where the height of gravity wall from top to bottom, within 5 feet from each side of a post, is less than 22 inches, provide concrete fence post footings and embed posts in accordance with the schedule of posts and footings as set forth in this section.
- C. Do not install footings on existing walls without the review of the ARCHITECT.

3.08 ALTERATIONS TO EXISTING FENCING

A. Resetting Fences:

1. Existing fences shall be reset where finish pavement is raised or lowered more than 6 inches from existing grade. Remove and reinstall entire fence assembly as specified in this Section.
 - a. Where the finish grade is raised 6 inches or less, cut and re-knuckle the existing fence fabric. Adjust tension wire and tie to fabric. Bottom of fence fabric shall be installed $\frac{3}{4}$ " above finish grade.
 - b. Where the finish pavement is lowered 6 inches or less, demolish the fence footing flush with the finish grade and adjust the fabric and its attachments. Bottom of fence fabric shall be installed $\frac{3}{4}$ inches above finish grade.
2. Where existing fencing posts are indicated to be removed, reset or relocated, remove posts including their concrete footings
 - a. Fill footing cavity with sand, compact and cap surface matching existing adjacent material.
 - b. Construct new concrete footings, as specified, in their designated location and set posts as indicated above in Framework Installation Article.
3. Bent posts, rails and accessories shall be replaced with new parts as specified to complete reinstallation. New materials shall closely match design of existing installation. Cut bent portion of posts and weld new sections of equal diameter and thickness. Install splice to inside of all welded section prior to welding. Previously repaired or welded posts shall be replaced.
4. Top rail is required in reinstalled fencing which does not have top rail in its existing condition. Install as specified for new installations.
5. Fabric Removal: Do not remove more than what can be replaced during one day unless a barricade, providing equal security, will be installed in its place. If freestanding temporary fence is used, it shall be clamped and wrap tied.
6. Remove and dispose of off-site concrete debris, chain link, hardware and accessories. Use new hardware and accessories.
7. Gates:
 - a. Remove non-welded type existing hinges and replace with OWNER provided weldable hinges. On existing welded hinges remove bolts and replace with new. Remove existing latches and replace with new.
 - b. Weld gate latches and hinges to posts as indicated for new fencing.

- B. Painting: Disassemble existing fence and all attachment hardware (bands, pipe, and wire) prior to preparation of posts for painting. Replace attachment hardware with new.
 - 1. Preparation: Prepare exposed steel posts, rails and accessories thoroughly cleaned of rust, oil and foreign materials. Painted galvanized metal shall be stripped to bare metal before applying prime coat.
 - 2. Priming: Spot prime areas from which the original surface coating had been removed with a metal primer to match adjoining surfaces. Subsequently, install a prime coat to the entire surface to be painted.
 - 3. First Coat: Install first coat as recommended by the paint manufacturer. Furnish a color that is 10 percent to 15 percent lighter or darker than the finish coat.
 - 4. Second or Finish Coat: Install finish coat after the first coat has cured.
 - 5. Install paint in accordance with manufacturer's written recommendations.
 - 6. Protect adjacent structures, walls, concrete or asphalt from paint.

3.09 INSTALLATION OF GATES

- A. Provide gates of the sizes indicated on Drawings. Allow clearance on gates of 1-1/2 inches at bottom and one inch at top. Construct gates installed in sloping areas to conform to the grade. Provide an opening in each gate for access to locking device or padlock. Knuckle ends of fabric cut for opening to eliminate hazards.
- B. Sliding Gates and Swing Gates: Fabricate and install as indicated on Drawings. Wheel housing shall be designed to fit tightly to roll track and prevent gate from rolling over objects. Unsupported cantilever type roll gates are not acceptable. Install gate stops in accordance with the drawings. Both top and track stops are required.

3.10 COMPLETION

- A. Completed fencing shall form continuous units between points indicated with required parts, accessories, and fittings provided and installed. Clean exposed metal surfaces of cement, grout and other foreign substances.
- B. Fill in holes left by removal of existing fence footings, except in areas where grading Work is indicated or specified, to existing grade with clean earth thoroughly compacted to at least same density as adjoining soil.

3.11 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

3.12 CLEANUP

- A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

CIP 689 – CLARK BUILDING RENOVATIONS

SECTION 32 8400 - PLANTING IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY

- A. It is the intent of the specifications and drawings that the finished system is complete in every respect and shall be ready for operation satisfactory to the City.
- B. The work shall include all materials, labor, services, transportation, and equipment necessary to perform the work as indicated on the drawings, in these specifications, and as necessary to complete the contract.

1.2 CONSTRUCTION DRAWINGS

- A. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, sleeves, etc. which may be required. Carefully investigate the structural and finished conditions affecting all of the work and plan the work accordingly, furnishing such fittings, etc. as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, and architectural features.
- B. Work called for on the drawings by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications. When an item is shown on the plans but not shown on the specifications or vice versa, it shall be deemed to be as shown on both. The Landscape Architect shall have final authority for clarification.
- C. Do not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences should be brought to the attention of the Landscape Architect as soon as detected. In the event this notification is not performed, the Contractor shall assume full responsibility for any revision necessary.

1.3 QUALITY ASSURANCE

- A. Provide at least one English speaking person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the manufacturer's recommended methods of installation and who shall direct all work performed under this section.
- B. Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturer of articles used in this contract furnish directions covering points not shown in the drawings and specifications.
- C. All local, municipal, and state laws, rules and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out. Anything contained in these specifications shall not be construed to conflict with any of the above rules and regulations of the same. However, when

these specifications and drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these specifications and drawings shall take precedence.

- D. All materials supplied for this project shall be new and free from any defects. All defective materials shall be replaced immediately at no additional cost to City.
- E. Secure the required licenses and permits including payments of charges and fees, give required notices to public authorities, verify permits secured or arrangements made by others affecting the work of this section.

1.4 SUBMITTALS

A. Water Pressure Test

- 1. After award of contract and before any irrigation system materials are ordered from suppliers or delivered to the job site, submit to the City a written verification of the existing water pressure on the project at each of the points of connection shown.
- 2. The water pressure test shall be performed to measure the dynamic water pressure at the point of connection at the maximum flow rate of the proposed irrigation system as shown on the point of connection note. Dynamic water pressure is when water is flowing through the point of connection. Static water pressure readings, water is not flowing, are not acceptable.
- 3. Written dynamic water pressure test confirmation shall be made on the contractor's letterhead and include the flow rate during the test, the recorded water pressure, the date of the test and the time of the test.

B. Material List:

- 1. After award of contract and before any irrigation system materials are ordered from suppliers or delivered to the job site, submit to the City a complete list of all irrigation system materials, or processes proposed to be furnished and installed as part of this contract.
- 2. The submittals materials list shall include the following information:
 - a. A title sheet with the job name, the contractor's name, contractor's address and telephone number, submittal date and submittal number.
 - b. An index sheet showing the item number (i.e. 1,2,3, etc.); an item description (i.e. irrigation head); the manufacturer's name (i.e. Hunter Industries); the item model number (i.e. I-40-ADV/36V); and the page(s) in the submittal set that contain the catalog cuts.
 - c. The catalog cuts shall be one or two pages copied from the most recent manufacturer's catalog that indicate the product submitted. Do not submit parts lists, exploded diagrams, price lists or other extra information.
 - d. The catalog cuts shall clearly indicate the manufacturer's name and the item model number. The item model number, all specified options and specified sizes shall be circled on the catalog cuts.
 - e. Submittals for equipment indicated on the legend without manufacturer names, or "as approved", shall contain the manufacturer, Class or Schedule, ASTM numbers and/or other certifications as indicated in these specifications.

3. Submittal materials list format requirements:
 - . Submittals shall be provided as one complete package for the project. Multiple partial submittals will not be reviewed.
 - a. Submittal package shall be stapled or bound in such a way as to allow for disassembly for review processing. Submittals shall not have tabs, tab sheets, spiral binding, or any other type of binding that will interfere with automated copying of submittals.
 - b. Submittal package shall have all pages numbered in the lower right hand corner. Page numbers shall correspond with submittal index.
 - c. Re-submitted packages must be revised to include only the equipment being re-submitted. Equipment previously reviewed and accepted shall not be re-submitted in the materials list/index sheet or in the catalog cut sheet package.
- C. Substitutions: If the Contractor wishes to substitute any equipment or materials for those equipment or materials listed on the irrigation drawings and specifications, they may do so by providing the following information to the Landscape Architect for approval.
 1. Provide a written statement indicating the reason for making the substitution.
 2. Provide catalog cut sheets, technical data, and performance information for each substitute item.
 3. Provide in writing the difference in installed price if the item is accepted.
- D. The Landscape Architect will allow no substitutions without prior written acceptance.
- E. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.
- F. The Landscape Architect will not review the submittal package unless provided in the format described above.

1.5 EXISTING CONDITIONS

- A. Verify and be familiar with the locations, size, and detail of points of connection provided as the source of water, and electrical supply connection to the irrigation system.
- B. Irrigation design is based on the available dynamic water pressure shown on the drawings. Verify water on the project prior to the start of construction. Should a discrepancy exist, notify the Landscape Architect prior to beginning construction.
- C. Prior to cutting into the soil, locate all cables, conduits, sewer septic tanks, and other utilities as are commonly encountered underground and take proper precautions not to damage or disturb such improvements. If a conflict exists between such obstacles and the proposed work, promptly notify the Landscape Architect who will arrange for relocations. Proceed in the same manner if a rock layer or any other such conditions are encountered.
- D. Protect all existing utilities and features to remain on and adjacent to the project site during construction. Repair all damage resulting from the operations or negligence at no additional cost.

- E. Install required sleeving as shown on the plans.
- F. Verify and be familiar with the existing irrigation systems in areas adjacent to and within the Project area of work.
- G. Protect all existing irrigation systems, in areas adjacent to and within the project area of work, from damage due to operations.
- H. Notify City's Representative if any existing system is temporarily shut off, capped or modified. Provide 48-hour notice, prior to turning off or modifying any existing irrigation system.
- I. Repair or replace all existing irrigation systems, in areas adjacent to and within the project area of work, damaged by the construction of this project. Adjacent irrigation systems shall be made completely operational and provide complete coverage of the existing landscaped areas. All repairs shall be complete to the satisfaction of the City's Representative.

1.6 INSPECTIONS

- A. Permit the Landscape Architect and City's representative to visit and inspect at all times any part of the work and shall provide safe access for such visits.
- B. Where the specifications require work to be tested by the Contractor, it shall not be covered over until accepted by the Landscape Architect or City's representative. The Contractor shall be solely responsible for notifying the Landscape Architect and/or City's representative a minimum of 48 hours in advance, where and when the work is ready for testing. Should any work be covered without testing or acceptance, it shall be, if so ordered, uncovered at no additional cost.
- C. Inspections will be required for the following at a minimum:
 - 1. Coverage test of irrigation system. Test shall be performed prior to any planting.
 - 2. Final inspection prior to start of maintenance period.
 - 3. Final acceptance prior to turnover.
- D. Site observations and testing will not commence without the field record drawings as prepared by the Contractor. Record drawings must be complete and up to date for each site visit.
- E. Work that fails testing and is not accepted will be retested. Hourly rates and expenses of the Landscape Architect and City's representative for re-inspection or retesting will be paid by the Contractor at no additional cost.

1.7 STORAGE AND HANDLING

- A. Use all means necessary to protect irrigation system materials before, during, and after installation and to protect the installation work and materials of all other trades. In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the Landscape Architect and City's representative at no additional cost.

- B. Exercise care in handling, loading, unloading, and storing plastic pipe and fittings under cover until ready to install. Transport plastic pipe only on a vehicle with a bed long enough to allow the pipe to lay flat to avoid undue bending and concentrated external load.

1.8 CLEANUP AND DISPOSAL

- A. Dispose of waste, trash, and debris in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction. Bury no such waste material and debris on the site. Burning of trash and debris will not be permitted. Remove and dispose of rubbish and debris generated by this work and works at frequent intervals or when ordered to do so by the City's representative.
- B. At the time of completion, the entire site will be cleared of tools, equipment, rubbish and debris which shall be disposed of off-site in a legal disposal area.

1.9 TURNOVER ITEMS

- A. Record Drawings:
 - 1. Record accurately on one set of drawings all changes in the work constituting departures from the original contract drawings and the actual final installed locations of all required components as shown below.
 - 2. The record drawings shall be prepared to the satisfaction of the City. Prior to final inspection of work, submit record drawings to the Landscape Architect.
 - 3. All record drawings shall be prepared using AutoCAD 2014 drafting software and the original irrigation drawings as a base. No manual drafted record drawings shall be acceptable. The Contractor may obtain digital base files from the Landscape Architect.
 - 4. Prior to final inspection of work, submit record drawings plotted onto vellum sheets for review by the Landscape Architect. After acceptance by the Landscape Architect re-plot the record drawings onto reproducible Mylar sheets. Provide record drawing information on a digital AutoCAD Release 2014 drawing file. All digital files shall be provided on a digital memory stick clearly marked with the project name, file descriptions and date.
 - a. Record drawing information and dimensions shall be collected on a day-to-day basis during the installation of the pressure mainline to fully indicate all routing locations and pipe depths. Locations for all other irrigation equipment shall be collected prior to the final inspection of the work.
 - b. Two dimensions from two permanent points of reference such as buildings, sidewalks, curbs, streetlights, hydrants, etc. shall be shown for each piece of irrigation equipment shown below. Where multiple components are installed with no reasonable reference point between the components, dimensioning may be made to the irrigation equipment. All irrigation symbols shall be clearly shown matching the irrigation legend for the drawings. All lettering on the record drawings shall be minimum 1/8 inch in size.
 - 5. Show locations and depths of the following items:
 - a. Point of connection (including water POC, pressure regulators, master control valves, flow sensors, etc.).
 - b. Isolation valves.

- c. Automatic remote control valves (indicate station number and size).
- d. Quick coupling valves.
- e. Routing of control wires where separate from irrigation mainline.
- f. Irrigation controllers (indicate controller number and station count).
- g. Related equipment (as may be directed).

B. Controller Charts:

- 1. Provide one controller chart for each automatic controller. Chart shall show the area covered by the particular controller. The areas covered by the individual control valves shall be indicated using colored highlighter pens. A minimum of six individual colors shall be used for the controller chart unless less than six control valves are indicated.
- 2. Landscape Architect must approve record drawings before controller charts are prepared.
- 3. The chart is to be a reduced copy of the actual "record" drawing. In the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a readable size.
- 4. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 20 mils in thickness.

C. Equipment:

- 1. Supply as a part of this contract the following items:
 - a. One (1) 60-inch gate valve keys with 2" AWWA operating nut for operation of gate valves.
 - b. Two (2) keys for each automatic controller.
 - c. One (1) valve quick coupler key with a 3/4" bronze hose bib, bent nose type with hand wheel and three (3) coupler lid keys.
 - d. Two (2) box cover keys or wrenches.
 - e. Two (2) extra rotor heads.
 - f. Ten (10) extra 6" pop-up sprinkler bodies.
 - g. Ten (10) extra 12" pop-up sprinkler bodies.
 - h. Five (5) extra 6" bubbler heads of each size and type.
- 2. The above equipment shall be turned over to City's authorized representative at the final inspection.

1.10 COMPLETION

- A. At the time of the pre-maintenance period inspection, the Landscape Architect and/or City's representative will inspect the work, and if not accepted, will prepare a list of items to be completed by the Contractor. Punch list to be checked off by Contractor and submitted to Landscape Architect or City's representative prior to any follow-up meeting. This checked off list to indicate that all punch list items have been completed. At the time of the post-maintenance period or final inspection the work will be re-inspected and final acceptance will be in writing by the Landscape Architect and/or City's authorized representative.
- B. The City's authorized representative shall have final authority on all portions of the work.

- C. Any settling of trenches which may occur during the one-year period following acceptance shall be repaired to the City's satisfaction by the Contractor without any additional expense to the City. Repairs shall include the complete restoration of all damage to planting, paving or other improvements of any kind as a result of the work.

1.11 GUARANTEE

- A. The entire irrigation system, including all work done under this contract, shall be unconditionally guaranteed against all defects and fault of material and workmanship, including settling of backfilled areas below grade, for a period of one (1) year following the filing of the Notice of Completion.
- B. Should any problem with the irrigation system be discovered within the guarantee period, it shall be corrected by the Contractor at no additional expense to City within ten (10) calendar days of receipt of written notice from City. When the nature of the repairs as determined by the City constitute an emergency (i.e. broken pressure line) the City may proceed to make repairs at the Contractor's expense. Any and all damages to existing improvement resulting either from faulty materials or workmanship, or from the necessary repairs to correct same, shall be repaired to the satisfaction of the City by the Contractor, all at no additional cost to the City.
- C. Guarantee shall be submitted on Contractors own letterhead as follows:

GUARANTEE FOR IRRIGATION SYSTEM

We hereby guarantee that the irrigation irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse, or neglect excepted. We agree to repair or replace any defective material during the period of one year from date of filing of the Notice of Completion and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the City. We shall make such repairs or replacements within 10 calendar days following written notification by the City. In the event of our failure to make such repairs or replacements within the time specified after receipt of written notice from City, we authorize the City to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

PROJECT NAME:

PROJECT LOCATION:

CONTRACTOR NAME:

ADDRESS:

TELEPHONE:

SIGNED:

DATE:

PART 2 - MATERIALS

2.1 SUMMARY

- A. Use only new materials of the manufacturer, size and type shown on the drawings and specifications. Materials or equipment installed or furnished that do not meet Landscape Architect's or City's standards will be rejected and shall be removed from the site at no additional cost.

2.2 PIPE

- A. Pressure supply lines downstream of backflow prevention unit shall be Class 315 solvent weld PVC pipe conforming to ASTM D2241.
- B. Non-pressure lines 3/4 inch in diameter and larger downstream of the remote control valve shall be Schedule 40 solvent weld PVC pipe conforming to ASTM D1785.
- C. Sleeves shall be Schedule 40 solvent weld PVC pipe conforming to ASTM D1785.
- D. All PVC piping shall be purple in color and carry appropriate recycled / reclaimed water warnings imprinted onto the pipe in black ink.

2.3 PLASTIC PIPE AND FITTINGS

- A. Pipe shall be marked continuously with manufacturer's name, nominal pipe size, schedule or class, PVC type and grade, National Sanitation Foundation approval, Commercial Standards designation, and date of extrusion.
- B. All plastic pipe shall be extruded of an improved PVC virgin pipe compound in accordance with ASTM D1785.
- C. All solvent weld PVC fittings shall be standard weight Schedule 40 (and Schedule 80 where specified on the irrigation detail sheet, all mainline fittings shall be Schedule 80 PVC) and shall be injection molded of an improved virgin PVC fitting compound. Slip PVC fittings shall be the "deep socket" bracketed type. Threaded plastic fittings shall be injection molded. All tees and ells shall be side gated. All fittings shall conform to ASTM D2464 and ASTM D2466.
- D. All threaded nipples shall be standard weight Schedule 80 with molded threads and shall conform to ASTM D1785.
- E. All solvent cementing of plastic pipe and fittings shall be a two-step process, using primer and solvent cement applied per the manufacturer's recommendations. Cement shall be of a fluid consistency, not gel-like or ropy. Solvent cementing shall be in conformance with ASTM D2564 and ASTM D2855.
- F. When connection is plastic to metal, female adapters shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be non-lead base Teflon paste, tape, or equal.

2.4 VALVES

A. Gate Valves:

1. Gate valves shall be of the manufacturer, size, and type indicated on the drawings.
2. Gate valves shall be constructed of an epoxy coated ductile iron body, gate, bonnet and stem. Gate valves shall have bell x bell connections.
3. Gate valves shall have a minimum working pressure of not less than 150 PSI and shall conform to AWWA standards.

B. Quick Coupler Valves:

1. Quick coupler valves shall be of the manufacturer, size, and type indicated on the drawings.
2. Quick coupler valves shall be brass with a wall thickness guaranteed to withstand normal working pressure of 150 psi without leakage. Valves shall have 1" female threads opening at base, with two-piece body. Valves to be operated only with a coupler key, designed for that purpose. Coupler key is inserted into valve and a positive, watertight connection shall be made between the coupler key and valve.
3. Quick coupler valve shall have a purple colored, locking vinyl lid.
4. Quick couplers shall be installed with a manufactured PVC and brass swing joint of the manufacturer, size, and type indicated on the drawings.

C. Master Control Valves:

1. Master control valves shall be of the manufacturer, size, and type indicated on the drawings.
2. Master control valves shall be electrically operated.
3. Master control valve shall be normally open type.
4. Provide Christy's valve ID tags for each master control valve ("MCV").

D. Flow Sensors:

1. Flow sensors shall be of the manufacturer, size, and type indicated on the drawings.
2. Provide Christy's valve ID tags for each flow sensor ("FS")

E. Automatic Control Valves:

1. Automatic control valves shall be of the manufacturer, size, and type indicated on the drawings.
2. Automatic control valves shall be electrically operated.
3. Provide Christy's valve ID tags for each remote control valve with valve number.
4. Automatic control valves shall be installed with PVC manifold assemblies of the manufacturer, size, and type indicated on the drawings.

F. Mainline Air Release Valve:

1. Mainline air release valve shall be of the manufacturer, size, and type indicated on the drawings.

2. Components of the mainline air release valve shall be of the manufacturer, size, and type indicated on the drawings.

2.5 VALVE BOXES

- A. Valve boxes shall be of the manufacturer, size, color, and type indicated on the drawings.
- B. The cover and box shall be capable of sustaining a load of 1,500 pounds.
- C. Valve box extensions shall be by the same manufacturer as the valve box.
- D. The plastic irrigation valve box cover shall be an overlapping type.
- E. The valve boxes shall be secured with a hexagon head bolt, washer and nut locking kit of the manufacturer indicated on the drawings.
- F. Master control valve, flow sensor, air release valve, and automatic control valve boxes shall be "standard sized" rectangular size. Valve box covers shall be marked "MV", "FS", "ARV", or "RCV" with the valve identification number "heat branded" onto the cover in 1 inch high letters / numbers.
- G. Gate valve, and quick coupler valve boxes shall be 10" circular size. Valve box covers shall be marked with "GV" or "QCV" "heat branded" onto the cover in 1 inch high letters.

2.6 AUTOMATIC CONTROLLER

- A. Automatic controller shall be of the manufacturer, size, and type indicated on the drawings.
- B. Automatic controller shall be a SMART controller capable of automatic programming adjustment based on weather data.
- C. Controller enclosure shall be of the manufacturer, size, and type indicated on the drawings.
- D. Controller shall be grounded according to local codes using equipment of the manufacturer, size, and type indicated on the drawings; or as required by local codes and ordinances.
- E. Rain sensor shall be of the manufacturer, size, and type indicated on the drawings.

2.7 ELECTRICAL

- A. All electrical equipment shall be NEMA Type 3, waterproofed for exterior installations.
- B. All electrical work shall conform to local codes and ordinances.

2.8 LOW VOLTAGE CONTROL WIRING

- A. Remote control wire shall be direct-burial AWG-UF type, size as indicated on the drawings, and in no case, shall the conductor size be smaller than 14 gauge.
- B. Connections shall of the manufacturer, size, and type indicated on the drawings.
- C. Controller ground wires shall be green in color or bare copper and in no case smaller than 6 gauge.
- D. All wire splices shall be made using U.L. Listed (for direct burial) waterproof wire connections of the manufacturer, size, and type indicated on the drawings.

2.9 IRRIGATION SPRINKLER HEADS AND BUBBLERS

- A. Irrigation sprinkler heads and bubbler heads shall be of the manufacturer, size, type, operating pressure, and discharge rate indicated on the drawings.
- B. Irrigation sprinkler heads and bubblers shall be installed with manufactured swing joints of the manufacturer, size, and type indicated on the drawings.
- C. Irrigation sprinkler heads and bubblers shall be used as indicated on the drawings.

2.10 MISCELLANEOUS EQUIPMENT

- A. Landscape Fabric:
 - 1. Landscape fabric for valve box assemblies shall be 5.0- oz. weight woven polypropylene weed barrier. Landscape fabric shall have a burst strength of 225 PSI, a puncture strength of 60 lbs. and capable of water flow of 12 gallons per minute per square foot.
 - 2. Type: DeWitt Pro 5 Weed Barrier or approved equal.
- B. Equipment such as unions, rebar stakes, stainless steel clamps, gravel bedding, and brick supports shall be the size and type indicated on the drawings and submitted for approval.

PART 3 - EXECUTION

3.1 SITE CONDITIONS

- A. Inspections:
 - 1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
 - 2. Verify that irrigation system may be installed in strict accordance with all pertinent codes and regulations, the original design, the referenced standards, and the manufacturer's recommendations.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Landscape Architect.
2. Do not proceed with installation in areas of discrepancy until all discrepancies have been resolved.

C. Grades:

1. Before starting work, carefully check all grades to determine that work may safely proceed, keeping within the specified material depths with respect to finish grade.
2. Final grades shall be accepted by the Engineer before work on this section will be allowed to begin.

D. Field Measurements:

1. Make all necessary measurements in the field to ensure precise fit of items in accordance with the original design. Coordinate the installation of all irrigation materials with all other work.
2. All scaled dimensions are approximate. Check and verify all size dimensions prior to proceeding with work under this section.
3. Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities, which are caused by their operations or neglect.

E. Diagrammatic Intent:

1. The drawings are essentially diagrammatic. The size and location of equipment and fixtures are drawn to scale where possible. Provide offsets in piping and changes in equipment locations as necessary to conform to structures and to avoid obstructions or conflicts with other work at no additional cost.

F. Layout:

1. Prior to installation, stake out all location of large radius rotor irrigation heads, valves, and automatic controller.
2. Layout irrigation system and make minor adjustments required due to differences between site and drawings. Where piping is shown on drawings under paved areas, but running parallel and adjacent to planted areas, install the piping in the planted areas.

G. Water Supply:

1. Connections to, or the installation of, the water supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no additional cost.

H. Electrical Service:

1. Connections to the electrical supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no additional cost.

2. Make final electrical connections to the irrigation controller. Electrical power source to controller locations shall be provided by others.
3. Contractor shall make electrical connections to the irrigation controller.

3.2 TRENCHING

- A. Excavations shall be straight with vertical sides, even grade, and support pipe continuously on bottom of trench. Trenching excavation shall follow layout indicated on drawings to the depths below finished grade and as noted. Where lines occur under paved area, these dimensions shall be considered below subgrade.
- B. Provide minimum cover of 24 inches for pressure supply lines.
- C. Provide minimum cover of 18 inches for control wires.
- D. Provide minimum cover of 24 inches for sleeves below pedestrian paving.
- E. Provide minimum cover of 36 inches for sleeves below vehicular travel ways.
- F. Provide minimum cover of 12 inches for non-pressure lateral lines.
- G. Pipes installed in a common trench shall have a 4-inch minimum space between pipes.

3.3 BACKFILLING

- A. Backfill material on all lines shall be the same as adjacent soil free of debris, litter, and rocks over 1/2 inches in diameter.
- B. Backfill shall be tamped in 4-inch layers under the pipe and uniformly on both sides for the full width of the trench and the full length of the pipe. Backfill materials shall be sufficiently damp to permit thorough compaction, free of voids. Backfill shall be compacted to dry density equal to adjacent undisturbed soil and shall conform to adjacent grades.
- C. Flooding in lieu of tamping is not allowed.
- D. Under no circumstances shall truck wheels be used to compact backfill.
- E. Provide sand backfill a minimum of 4 inches over and under all piping under paved areas.

3.4 PIPING

- A. Piping under existing pavement may be installed by jacking, boring, or hydraulic driving. No hydraulic driving is permitted under asphalt pavement.
- B. Cutting or breaking of existing pavement is not permitted.
- C. Carefully inspect all pipe and fittings before installation, removing dirt, scale, burrs, and reaming. Install pipe with all markings up for visual inspection and verification.

- D. Remove all dented and damaged pipe sections.
- E. All lines shall have a minimum clearance of 4 inches from each other and 12 inches from lines of other trades.
- F. Parallel lines shall not be installed directly over each other.
- G. In solvent welding, use only the specified primer and solvent cement and make all joints in strict accordance with the manufacturer's recommended methods including wiping all excess solvent from each weld. Allow solvent welds at least 15 minutes setup time before moving or handling and 24 hours curing time before filling.
- H. PVC pipe shall be installed in a manner, which will provide for expansion and contraction as recommended by the pipe manufacturer.
- I. Center load all plastic pipe prior to pressure testing.
- J. All threaded plastic-to-plastic connections shall be assembled using Teflon tape or Teflon paste.
- K. For plastic-to-metal connections, work the metal connections first. Use a non-hardening pipe dope on all threaded plastic-to-metal connections, except where noted otherwise. All plastic-to-metal connections shall be made with plastic female adapters.

3.5 VALVES

- A. Master valves, flow sensors, gate valves, mainline air release valves, automatic control valves, and quick coupler valves are to be installed in the approximate locations indicated on the drawings.
- B. Install valves as indicated in the detail drawings.
- C. Install all valves a minimum of 18 inches off of any adjacent hardscape features.
- D. Valves to be installed in valve boxes shall be installed one valve per box.
- E. Provide valve ID tags for each automatic control valve with valve number.

3.6 VALVE BOXES

- A. Valve boxes shall be installed in shrub areas whenever possible.
- B. Each valve box shall be installed on a foundation of four bricks and the boxes shall be filled with 3/4 inch gravel backfill to a depth of 4 inches in the bottom of the box. Valve boxes shall be installed with their tops 2 inches above finish grade in ground cover areas.
- C. Valve boxes shall be wrapped with landscape fabric to cover the entire bottom and sides of the box to prevent soil intrusion.

- D. Heat brand the identifying letters and numbers onto the box lid.
- E. Secure all valve box lids with the locking kit.

3.7 CONTROLLER

- A. The exact location of the controller shall be approved by the Landscape Architect or City's representative before installation. The electrical service shall be coordinated with this location.
- B. The Contractor shall be responsible for the final electrical hook up to the irrigation controller.
- C. The irrigation system shall be programmed to operate during the periods of minimal use of the design area.
- D. Register the controller with the manufacturer, start the subscription weather download service and fully program the controller for automatic programming adjustment using the weather data. Provide proof of registration and controller programming to the City's representative.
- E. Program the controller to receive flow sensor inputs and provide shut down to detect leaks in the irrigation system.
- F. Ensure that the placement of the rain sensor allows for communication with the controller as required by the manufacturer.

3.8 CONTROL WIRING

- A. Low voltage control wiring shall occupy the same trench and shall be installed along the same route as the lateral lines.
- B. Wires shall be secured to the mainline with tape at intervals of 20 feet.
- C. Provide a 12 inch wire expansion loop at all directional changes and tees on the wire path.
- D. All waterproof connections shall be of an approved type and shall occur in a valve box. Provide an 36-inch service loop at each connection.
- E. An expansion loop of 36 inches shall be provided at each wire connection and/or directional change, and one of 36 inches shall be provided at each automatic control valve.

3.9 IRRIGATION SPRINKLER HEADS AND BUBBLERS

- A. Irrigation sprinkler heads and bubblers shall be installed as indicated on the drawings.
- B. Spacing of sprinkler heads shall not exceed maximum indicated on the drawings.
- C. Riser nipples shall be of the same size as the riser opening in the sprinkler body.
- D. Install all heads with swing joints.

3.10 FLUSHING THE SYSTEM

- A. Prior to installation of irrigation heads, the valves shall be opened, and a full head of water used to flush out the lines and risers.
- B. Irrigation heads shall be installed after flushing the system has been completed.

3.11 ADJUSTING THE SYSTEM

- A. Contractor shall adjust valves and check the coverage of each system prior to coverage test.
- B. If it is determined by the Landscape Architect or City's authorized representative that additional adjustments or nozzle changes will be required to provide proper coverage, all necessary changes or adjustments shall be made prior to any planting at no additional cost.
- C. The entire system shall be operating properly before any planting operations commence.
- D. Automatic control valves are to be adjusted so that the irrigation sprinkler heads and bubblers operate at the pressure recommended by the manufacturer.

3.12 TESTING AND OBSERVATION

- A. Do not allow or cause any of the work of this section to be covered up or enclosed until it has been observed, tested and accepted by the Landscape Architect and/or City's representative.
- B. The Contractor shall be solely responsible for notifying the Landscape Architect and City's representative a minimum of 48 hours in advance, where and when the work is ready for testing.
- C. When the irrigation system is completed, the Contractor shall perform a coverage test of each system in its entirety to determine if the water coverage for the planted areas is complete and adequate in the presence of the Landscape Architect.
- D. Furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from the plans, or where the system has been willfully installed as indicated on the drawings when it is obviously inadequate, without bringing this to the attention of the Landscape Architect. This test shall be accepted by the Landscape Architect and accomplished before starting any planting.
- E. Areas to be maintained for the formal maintenance period shall start maintenance at the same time, as directed by the Landscape Architect and/or City's representative. Partial areas will not be released into maintenance prior to completion of items listed in the pre-maintenance review.
- F. Final inspection will not commence without record drawings as prepared by the Contractor.

3.13 MAINTENANCE

- A. During the maintenance period adjust and maintain the irrigation system in a fully operational condition providing complete irrigation coverage to all intended plantings.

3.14 COMPLETION CLEANING

- A. Clean up shall be made as each portion of the work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be swept, and any damage sustained on the work of others shall be repaired to original conditions.

END OF SECTION 32 84 00

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SECTION 329113 – SOIL PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work, as required to make a complete and thorough preparation of the planting soil, including soil amendment products, imported topsoil, as required, to make up deficiencies in quantity of soil available on site, as shown in the Contract Drawings, and as specified herein this Section.
- B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:
 - 1. Agronomic Soil Fertility Testing and Soil Percolation Testing.
 - 2. Topsoil.
 - 3. Pre-Plant Weed Control.
 - 4. Soil Conditioners, Amendments and Fertilizers (Organic & Chemical).
- C. Related Sections: The following Sections contain requirements that relate to Work in this Section:
 - 1. Section 312219 – Landscape Grading.
 - 2. Section 328400 – Landscape Irrigation
 - 3. Section 329200 – Lawns and Grasses.
 - 4. Section 329300 – Exterior Plants.
 - 5. Section 329400 – Landscape Planting Accessories.
 - 6. Section 329813 – Landscape Establishment Period.

1.2 DEFINITIONS AND APPLICABLE STANDARDS

- A. References:
 - 1. USDA – United States Department of Agriculture.
 - 2. ASTM – American Society for Testing & Materials.
- B. Definitions:
 - 1. *Topsoil* - Shall be friable soil, providing sufficient structure in order to give good tilth and aeration to the soil. Topsoil shall be free of roots, clods, stones larger than one-inch (1”) in the greatest dimension, pockets of coarse sand, noxious weeds, sticks, lumber, brush and other litter. It shall not be infested with nematodes or other undesirable disease-causing organisms such as insects and plant pathogens.
 - 2. *Gradation Limits* - Soil shall be a sandy loam, loam, clay loam or clay. The definition of soil texture shall be per the USDA classification scheme. Gravel over ¼-inch in diameter shall be less than 20% by weight.
 - 3. *Permeability Rate* - Hydraulic conductivity rate shall be not less than one-inch (1”) per hour, nor more than twenty-inches (20”) per hour, when tested in accordance with the USDA Handbook Number 60, Method 34b, or other approved Methods.
 - 4. *Fertility* - The range of the essential elemental concentration in soil shall be as follows:

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<u>Ammonium Bicarbonate/ DTPA Extraction (PPM)</u>		
Element	Concentration of elements for Soil Selection, measured as mg/kilogram dry weight basis	Concentration of Elements for Final Acceptance (amended and conditioned soil) measured as mg/kilogram dry weight basis
Phosphorous	2 - 40	10 - 40
Potassium	40 - 220	100 - 220
Iron	2 - 35	24 - 35
Manganese	0.3 - 6	0.6 - 6
Zinc	0.6 - 8	1 - 8
Copper	0.1 - 5	0.3 – 5
Boron	0.2 - 1	0.2 – 1
Magnesium	50 - 150	50 – 150
Sodium	0 - 100	0 – 100
Sulfur	25 - 500	25 – 500
Molybdenum	0.1 – 2	0.1 - 2

5. *Acidity* - The soil pH range measured in the saturation extract (Method 21a, USDA Handbook Number 60) shall be 6.0 – 7.9.
6. *Salinity* - The salinity range measured in the saturation extract (Method 3a, USDA Hand Number 60) shall be 0.5 – 2.0 dS/m. If calcium and if sulfate ions both exceed 20 milliequivalents per liter in the saturation extract, the maximum salinity shall be 4.0 dS/m.
7. *Chloride* - The maximum concentration of soluble chloride in the saturation extract (Medoth3a, USDA Handbook Number 60) shall be 150 mg/1 (parts per million).
8. *Boron* - The maximum concentration of soluble boron in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 1 mg/1 (parts per million).
9. *Sodium Adsorption Ratio (SAR)* - The maximum SAR shall be 3 measured per Method 20b, USDA Handbook Number 60.
10. *Aluminum* – Available aluminum measured with the Ammonium Bicarbonate/DTPA Extraction shall be less than 3.0 parts per million.
11. *Soil Organic Matter Content* - Sufficient soil organic matter shall be present to impart good physical soil properties but not be excessive to cause toxicity or cause excessive reduction in the volume of soil due to decomposition of organic matter. The desirable range is 3% to 5%. The carbon:nitrogen ratio should be about 10. A high carbon:nitrogen ratio can indicate the presence of hydrocarbons or non-humified organic matter.
12. *Calcium Carbonate Content* - Free calcium carbonate (limestone) shall not be present in acid-loving plants.
13. *Heavy Metals* - The maximum permissible elemental concentration in the soil shall not exceed the following concentrations:

<u>Ammonium Bicarbonate/DTPA Extraction (PPM)</u>	
<i>Element</i>	<i>(mg/kilogram) dry weight basis</i>

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Arsenic	1.0
Cadmium	1.0
Chromium	10.0
Cobalt	2.0
Lead	30.0
Mercury	1.0
Nickel	5.0
Selenium	3.0
Silver	.5
Vanadium	3.0

- a. If the soil pH is between 6 and 7, the maximum permissible elemental concentration shall be reduced 50% to the above values. If the soil pH is less than 6.0, the maximum permissible elemental concentration shall be reduced 75% of the above values. No more than three (3) metals shall be present at 50% or more of the above values.
14. *Phytotoxic constituent, herbicides, hydrocarbons, etc.* – Germination and growth of plants shall not be restricted more than 10% compared to the reference soil. Total petroleum hydrocarbons shall not exceed 50 mg/kg dry soil measured per the modified EPA Method No. 8015. Total aromatic volatile organic hydrocarbons (benzene, toluene, xylene and ethylbenzene) shall not exceed 0.5 mg/kg dry soil measured per EPA Method No. 8020.
15. *Sub Grade* - Soil level resulting from the rough grading work under another Section. Cultivation of sub grade areas prior to placement of Topsoil is included in this Section.
16. *Stockpiled Topsoil* - Soil stockpiled for spreading over prepared sub-grade.
17. *Stockpiled Native Topsoil* - Topsoil stripped from the site prior to rough grading Work (under another Section), to be spread and amended as Work under this Section.
18. *Imported Topsoil* - Off-site Topsoil, imported and stockpiled under this Section, to be spread and amended as Work under this Section.

C. Measurements:

1. PPM: Measurement, in parts per million.

1.3 SUBMITTALS

A. General:

1. Collect information into a single Submittal for each element of construction and type of product or equipment identified under this Section for review.
2. To expedite review, Submittal shall be organized and presented into specific sections or headings. Furnish neat, concise, legible, and clearly identifiable information, and sufficiently explicit detail, to enable proper evaluation for Contract compliance. Highlight catalog, product data, or brochures containing various products, sizes, and materials to show particular item submitted.
3. Submittal Format: As applicable, furnish Submittal as a single electronic digital PDF (Portable Document Format) file.

B. Digital Submittal Information:

1. Product/Material Data. Submit available product/material literature supplied by manufacturer's, indicating that their products comply with specified requirements. Provide manufacturing source (name, address, and telephone number), and distributor source (name, address, and telephone number) for each type of product/material.

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- a. Planting Soil (Imported/Amended Topsoil).
 - b. Soil Amendments (for each type used, for Sand, Perlite, Peat Humus, Gypsum, Soil Sulfur, Iron, etc).
 - c. Bulk Composted Organic Soil Amendment Material.
 - d. Granular Soil Conditioning Material.
 - e. Mycorrhizal Inoculum.
 - f. Fertilizers (for each type used).
2. Agronomic Soil Fertility Analysis and Recommendations: Submit a minimum of fourteen (14) days prior to amending of the soil and ordering soil amendments. The locations of where each of the soil test samples were derived from the Project Site shall be keyed to the site plan and shall be included with the results.
 3. Qualification Data: Submit names for firms and persons specified in the “Quality Assurance and Control” Article to demonstrate their capabilities and experience on similar installations.
 4. Receipts and photo documentation (dated for the project) of all soil preparation products purchased and installed for are to be provided to Owner and Landscape Architect for record purposes.
- C. Material Samples: Submit four (4) sets of physical Material Samples for review of kind, color, pattern, size, and texture for a check of these characteristics with other elements, and for a comparison of these characteristics between Submittal and actual component as delivered and installed. Include the full range of exposed color and texture expected in the completed Work. Provide Material Samples bound and individually wrapped in re-sealable labeled 1-gallon plastic bags (as applicable):
1. Provide Material Sample sets for each item submitted under Product/Material Data.
- D. Submittals under this Article will be rejected without the benefit of review by the Landscape Architect if they are difficult to read due to insufficient scale, poor image quality, or poor drafting quality; or if the required information is missing or not presented in the format as requested.
- E. No Work shall proceed under this Section until Submittal requirements indicated herein have been reviewed accordingly by the Landscape Architect.
- ### 1.4 QUALITY ASSURANCE AND CONTROL

- A. Installer Qualifications for requirements indicated herein this Section:
1. Licensed Landscape Contractor, C-27, in the State of California.
 - a. Engage an experienced, licensed Contractor who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.
 - b. Installer's Field Supervision: Contractor shall maintain an experienced, full-time landscape supervisor/superintendent at the Project Site during times that landscaping operations identified herein the Contract are in progress.
- B. Manufacturer's Directions: Follow Manufacturer's directions and drawings in cases where the Manufacturers of articles used in this Section furnish directions covering points not shown in the Contract Drawings or Contract Specifications.
- C. Permits, Fees, Bonds, Testing, and Inspections: Contractor shall arrange and pay for permits, fees, bonds, testing, and inspections necessary to perform and complete his portion of the Work.

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- D. Approved Testing Laboratory and Procedures for Agronomic Soil Fertility Analyses:
1. Agronomic Soil Fertility Analyses shall be conducted by a reputable, certified, agronomic soils laboratory. Laboratory shall be a member of the Council on Soil Testing and Plant Analysis. The same laboratory shall be used throughout the duration of the Contract:
 - a. Wallace Laboratories, El Segundo, CA. 310-615-0116.
 - b. Soil and Plant Laboratory, Orange, CA. 714-282-8777.
 - c. Fruit Growers Laboratory, Santa Paula, CA. 805-659-0910.
 2. Contractor shall verify and confirm the selected Testing Laboratory and specific location(s) of soil sample(s) with the Landscape Architect prior to commencing soil sampling operations.
 3. For each Soil type, submit the physical Soil Samples directly to the selected Laboratory for analysis, per the procedures outlined per Part III herein this Section.
 - a. In addition to the physical Soil Samples, Contractor shall also provide the Laboratory with a copy of the Soil Amendment and Fertilizer products indicated herein this Section.
 4. Along with the testing data results, the Agronomic Soil Fertility Analysis shall also include written recommendations authored by the Laboratory conducting the Analyses for amending, treating, and/or correcting the sampled soils. Laboratory shall utilize the organic-based Soil Amendments and Fertilizers described herein this Section to the greatest extent possible to produce satisfactory planting soil(s) suitable for sustaining healthy viable plant growth.
 - a. The Analyses shall also include Maintenance and Post-Maintenance fertilization programs for planted areas within the Contract.
 5. Agronomic Soil Fertility Analyses shall be performed on each Soil Type samples, and include testing results for the following:

pH;
Electro-conductivity (salinity) measurement – saturated extract.
Measurement of sodicity (Sodium Absorption Ratio);
Estimate of soil texture and soil organic matter;
Presence of lime;
Nutrients/Toxic Elements measurement of DPTA extract
Saturation extracts for nitrate, sulfate, sodium, calcium, magnesium, potassium, soluble phosphate, and boron;
Parasitic nematodes;
Herbicide contamination;
(For Lightweight Soil Mixes): Test for physical and chemical composition, and saturated weight per cu.ft.

6. Planting operations shall not commence until the results of the Agronomic Soil Fertility Analysis and Recommendations are reviewed accordingly by the Landscape Architect.
7. The quantity or type of amendments may be modified by the Landscape Architect within fourteen (14) days of receipt of the results. The Agronomic Soil Fertility Analysis and Recommendations shall take precedence over the amendment and fertilizer application rates specified herein or on the Contract Documents.
8. The Agronomic Soil Fertility Report/Recommendation shall take precedence over the amendment and fertilizer application rates specified herein or on the Contract Documents.

1.5 DELIVERY, STORAGE, AND HANDLING

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- A. General: Deliver and install materials so as to not delay Work, and install only after preparations for installation have been completed.
 - 1. Packaged Materials: Deliver packaged materials in original, unopened packages or containers, with manufacturer's labels intact and legible, showing weight, analysis, and name of manufacturer. Store and secure properly to prevent theft or damage.
 - a. Store packaged materials off ground and under cover, away from damp surfaces and inclement weather.
 - b. Protect during storage and construction against soilage or contamination from earth and other materials.
 - 2. Bulk Materials:
 - a. Deliver and store bulk materials so as not to impede Work of others.
 - b. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas, or plants.
 - c. Protect during storage and construction against soilage or contamination from earth and other materials. Provide adequate separation between bulk materials so as not to cross-contaminate bulk materials.
 - d. Store under cover, away from inclement weather.
 - e. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water run-off, and airborne dust reaching adjacent properties, water conveyance systems, structures, or walkways.
 - f. Accompany each delivery of bulk materials (fertilizers, amendments, topsoil, etc.) with appropriate certificates. Furnish original certificates to Landscape Architect upon request.

1.6 COORDINATION, SCHEDULING, AND OBSERVATIONS

- A. Notify the Contractors performing Work related to installation of Work under this Section in ample time so as to allow sufficient time for them to perform their portion of Work and that progress of Work is not delayed. Verify conditions at the Project Site for Work that affects installation under this Section. Coordinate items of other trades to be furnished and set in place.
- B. Utilities: Determine location of above grade and underground utilities and perform Work in a manner which will avoid damage to utilities. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.
- C. Excavation: When conditions detrimental to adequate Soil Preparation operations are encountered, such as rubble fill, adverse drainage conditions, or obstructions, cease operations and notify Landscape Architect for further direction.
- D. Installation: Perform Soil Preparation operations only when weather and soil conditions are suitable in accordance with locally accepted practices.
- E. Construction Site Observations: Periodic site observations shall be made by the Landscape Architect during the installation of Work under this Section for compliance with requirements for type, size, and quality. Landscape Architect retains right to observe Work for defects and to reject unsatisfactory or defective material at any time during progress of Work. Contractor shall remove rejected materials immediately from Project site. The Contractor shall request, in writing, at least one (1) week in advance of the time when mandatory site observation(s) by the Landscape Architect are required.

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1.7 SITE CONDITIONS

- A. Project Site shall be free of weeds, native grasses, evasive grasses, (Bermuda Grass, Nut Grass, Kikiyu Grass, etc.) prior to Topsoil distribution or soil amendment placement.
- B. Excessive rock, dead or declining vegetation, trash, debris, or other items that has accumulated throughout the duration of the Project shall be removed from the Project Site by the Contractor, and as directed by the Landscape Architect.
- C. Grading and soil preparation Work shall be performed only during the period when beneficial and optimum horticultural results may be obtained. If the moisture content of the soil should reach such a level that working it would destroy soil structure or cause compaction, spreading and grading operations shall be suspended until, in the opinion of the Landscape Architect, the moisture content is increased or reduced to acceptable levels and the desired results are likely to be obtained.
 - 1. Soil moisture level prior to planting shall be no less than 75% of field capacity. The determination of adequate soil moisture for planting shall be in the sole judgment of the Landscape Architect.
 - 2. If the soil moisture level is found to be insufficient for planting, planting pits shall be filled with water and allowed to drain before commencing planting operations.
- D. Planting areas which become compacted in excess of 85% relative compaction due to construction activities shall be tilled and thoroughly cross-ripped to a minimum depth of twelve-inches (12”) to alleviate the condition, taking care to avoid all existing subsurface utilities, drainage, etc.

1.8 SUBSTITUTIONS

- A. Consideration: Materials to be considered equal to the Materials indicated herein this Section shall be reviewed by the Landscape Architect. Materials with equal performance characteristics produced by other Manufacturer’s and/or Distributors may be considered, providing deviations in dimensional size, color, composition, operation, and/or other characteristics do not change the design concept, aesthetic appearance, nor intended performance, as solely judged by the Landscape Architect. The burden of proof on product equality is on the Contractor.
- B. Specific reference to Manufacturer’s names and products specified herein are used as standards of quality. This implies no right to the Contractor to substitute other materials without prior written approval by the Landscape Architect for Work under this Section.
- C. Materials substituted and installed by the Contractor, without prior written approval by the Landscape Architect, may be rejected. Contractor shall not be entitled to be compensated by the Owner where the Contractor has installed rejected substitutions without receiving prior written approval.
- D. Contract Price: Substituted Materials under this Section shall not increase the Contract price.

PART 2 - PRODUCTS

2.1 SOIL MIXES/BLENDS

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A. Soil Conditioner Blend, for amending on-site native soil planting surfaces, stockpiled, plant back fill or imported topsoil: Furnish a thoroughly blended composition of Bulk Composted Organic Soil Amendment Material and Granular Soil Conditioning Material & Fertilizer. Any substitution for the “Soil Conditioner Blend” listed herein must be requested by the Contractor and approved, in writing, by the Landscape Architect at least thirty (30) days prior to installation.

1. Bulk Composted Organic Soil Amendment Material:

- a. Material Composition: Bulk Composted Organic Soil Amendment Material shall be thoroughly cured for a minimum of 100 days, and shall be free from any trash (glass, metal, plastic, etc.) deleterious materials, bio-solids, and/or toxic chemicals. The Material shall be non-hazardous, and conform to US Environmental Protection Agency 40 CFR503 criteria for “Class A” products. It shall also exceed standards and specifications for unrestricted application as a landscaping and agricultural soil amendment.
- b. Humus material shall have an acid-soluble ash content of no less than 6% and no more than 20%. The organic matter content shall be at least 50% on a dry weight basis.
- c. Types of acceptable products are composts, manures, mushroom composts, straw, alfalfa, peat mosses etc. low in salts, low in heavy metals, free from weed seeds, free of pathogens and other deleterious materials.
- d. Composted wood products are conditionally acceptable [stable humus must be present]. Wood based products are not acceptable which are based on red wood or cedar.
- e. Sludge-based materials are not acceptable.
 - 1) Gradation/Screen Analysis: A minimum of 90% of the material by weight shall pass a 1/2” screen. Material passing the screen shall meet the following criteria:

<i>Percent Passing</i>	<i>Sieve Designation</i>
80 - 100%	6.35 mm (1/4")
50 – 80%	2.38 mm (No. 8)
0 – 40%	500 micron (No. 35)

- 2) Maturity: Physical characteristics suggestive of maturity include shall include:
 - a) Color: Dark brown to black.
 - b) Odor: Aerobic, without malodorous presence of decomposition products.
 - c) Particle characterization: Identifiable wood pieces are acceptable but the balance of Material should be soil-like without recognizable grass or leaves.
- f. Analytical Properties: Contractor shall submit proof of the Bulk Composted Organic Soil Amendment Material by providing a sample as identified herein this Section, and a lab analysis that has been performed within 30 days of the installation of the planting. Soil mix shall have (at a minimum) the following properties:

<i>Material</i>	<i>Minimum Targeted Property/Range</i>
Total Nitrogen (N%)	.50-1.0%
Phosphorus (as P2O5)	2.0%

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Potassium (as K ₂ O)	0.2%
pH (units)	6.0 to 7.5, as determined in saturated paste.
Organic Content	Minimum 50% based on dry weight and determined by ash method. Minimum 205 lbs. organic matter per cubic yard of compost.
ECe (millimho/cm)	<5.0; based on pre-leaching with equal volume of water.
Carbon-to-Nitrogen Ratio	<25-to-1, nitrogen stabilized.
Bulk Density	1,000 to 1,100 pounds/cubic yard.
Sodium Absorption Ratio (SAR)	Under 20.0
Total Iron	1.5%3.
Moisture Content	35%-60%
Acid-soluble Ash content	No less than 6% and no greater than 20%.
Salt Content	<10millimho/cm @ 25d C. on a saturated paste extract.
Boron Content	<1.0 parts per million on a saturated paste extract.
Silicon-Content (acid-insoluble ash)	<50%
Calcium Carbonate	No presence on alkaline soils.
Maximum Total Permissible Pollutant Concentrations Parts per million (mg/kg dry-weight basis)	<ul style="list-style-type: none"> • Arsenic: 1.0 • Cadmium: 1.0 • Chromium: 10.0 • Cobalt: 2.0 • Copper: 1.0 • Lead: 30.0 • Mercury: 1.0 • Molybdenum: 2.0 • Nickel: 5.0 • Selenium: 1.0 • Silver: 0.5 • Vanadium: 3.0 • Zinc: 2.0

- g. Application Rate: As indicated herein this Section under “Planting Soil Amendments Schedule”.
- h. Commercial-Grade Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
- 1) *Soil Conditioner*, Synagro Professional Organic Soil Products.
 - 2) *Agromend*, Agromin Horticultural Products.
 - 3) *Humic Compost 1/2”*, Greenway Compost.
 - 4) *Superior Blend Compost*, Artesia Sawdust Products, Inc.
 - 5) *Compost*, EarthWorks Soil Amendments, Inc.
 - 6) *Contractor’s Blend*, Recycled Wood Products (RWP).
 - 7) *#SSA-CST Supreme Organic Soil Amendment*, Plants Choice, Inc.
 - 8) *Humic Compost 3/8”*, Agri Service, Inc.

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- 9) Or equal, as approved by the Landscape Architect.
- 2. Granular Soil Conditioning Material & Fertilizer:
 - a. Material Composition and Analytical Properties: Granular Soil Conditioning Material & Fertilizer shall be a singular manufacturer-blended combination of soil conditioning material and fertilizer. It shall be granular in form, long-lasting, free flowing, and suitable for application with approved equipment. It shall not contain any sewage sludge or manure-based products, and shall contain the following guaranteed minimum available analysis range:

<u>Element/Material</u>	<u>Targeted Property Range</u>
Nitrogen (N)	5.0% to 6.0%
Phosphoric Acid (as P2O5)	2.0% to 3.0%
Potash (as K2O)	1.0% to 4.0%
Humic Acids	15.0 % to 20.0%
Calcium	7.0%
Sulfur	0.0% to 5.0%

- b. Commercial-Grade Products, Manufacturers and Associated Rates of Application: Subject to compliance with requirements, provide products by one (1) of the following:
 - 1) *Tri-C 6-2-4*, Tri-C Enterprises LLC, Chino, CA. 800-927-3311.
 - a) Application Rate at 70 lbs. per 1,000 square feet of planting area.
 - 2) *Gro-Power Plus 5-3-1*, Gro-Power, Chino, CA. 909-393-3744.
 - a) Application Rate at 200 lbs. per 1,000 square feet of planting area.
 - 3) or equal, as approved by the Landscape Architect.

2.2 ORGANIC SOIL AMENDMENT COMPONENTS

A. Peat Humus:

- 1. Type: Canadian Sphagnum Peat, as derived from the genus Sphagnum, medium-divided, coarse fibrous texture, brown in color.
- 2. Measurement: Measure peat in air dry condition, containing not more than 35% moisture by weight on an "as-received" basis.
- 3. Physical Properties:

<u>Percent Passing</u>	<u>Sieve Size</u>
95 - 100%	9.51 mm (3/8 in.)
0 - 40%	500 micron (#35, 32 mesh)

- 4. Organic Content (dry weight basis): Minimum 95%.
- 5. Fiber Content: Greater than 66%.
- 6. Water Holding Capacity: 20x to 30x its dry weight in water.
- 7. Range in Ash Content (%): 1.0 to 5.0.
- 8. Chemical Properties:
 - a. Nitrogen (dry weight basis): 0.6-3.0%.

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- b. Salinity/Soluble Salts: Saturation extract conductivity 0.0-3.0 millimhos/cm @ 25 degrees C.
- c. pH range: 3.0 to 4.0.
- 9. Unacceptable Materials:
 - a. Coir Dust.
 - b. Sedge Peat.
 - c. Reed Peat.
 - d. Hypnum Peat.
- B. Mycorrhizal Inoculum:
 - 1. Mycorrhizal Inoculum for Plant Material (not Palm Trees): Dual soil-conditioning biological inoculum system of endo-and ecto- Mycorrhizal, used to further aid the plants ability to efficiently uptake available soil nutrients and increase resistance to drought.
 - a. Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
 - 1) *4-gram Myco-Pak*, Tri-C Enterprises LLC, Chino, CA, 800-927-3311.
 - 2) *4 oz. Packet - Roots 1 Step*, Roots, Inc., Independence, MO, 800-342-6173.
 - 3) Or equal, as approved by the Landscape Architect.
 - b. Provide at the prescribed application rate, per the Manufacturer's written recommendations.

2.3 CHEMICAL SOIL AMENDMENT COMPONENTS

- A. General: Chemical Soil Amendment Components listed herein may or may not be used, depending on the results of the Agronomic Soil Fertility Report. Provide as required:
- B. Gypsum: Commercially-processed and packaged agricultural-grade hydrated calcium sulfate product (CaSO₄), 92.0% minimum, pH at 7.1.
 - 1. Commercial-Grade Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
 - a. *Ben Franklin® No. 1 Agricultural Gypsum*, U.S. Gypsum Company.
 - b. *100% Good Stuff Gypsum™*, Art Wilson Company.
 - c. *CAL-SUL® Pelletized Agricultural Gypsum*, North Pacific Group.
 - d. *Bumper Harvest Agricultural Gypsum*, Domtar Gypsum.
 - e. *Premium 97 Solution-Grade Gypsum*, Diamond K, Inc.
 - f. Or equal, as approved by the Landscape Architect.
- C. Soil Sulfur: Elemental Sulfur (90% min.) commercially manufactured, water degradable, palletized.
 - 1. Commercial-Grade Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
 - a. *Disper-Sul*, Martin Resources, Inc.
 - b. *Soil Sulfur*, Red Top.
 - c. Or equal, as approved by the Landscape Architect.
- D. Iron: Non-staining, 40% Fe minimum, complete with micro-nutrients and 2% humic acids, as derived from iron oxide, manganese oxide, or zinc oxide.
 - 1. Commercial-Grade Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
 - a. *Gro-Power Iron*, Gro-Power, Chino, CA.

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- b. *Iron 45 w/ Micronutrients*, Tri-C Enterprises LLC, Chino, CA.
- c. Or equal, as approved by the Landscape Architect.

- E. Dolomite Lime: Agricultural-grade mineral soil conditioner containing 35% minimum magnesium carbonate, and 49% minimum calcium carbonate, 100% passing #65 sieve.
- F. Potassium Sulfate (Sulfate of Potash K2O), (0-0-50 guaranteed analysis N-P2O5-K2O): Agricultural-grade, containing minimum 50% of water-soluble potash and 18% Sulfur (S).
- G. Single Superphosphate P2O5 (0-15-0 guaranteed analysis N-P2O5-K2O): Commercial product, containing 15% available phosphoric acid and 14% Sulfur.
- H. Triple Superphosphate P2O5, (0-45-0 guaranteed analysis N-P2O5-K2O): Commercial product, containing 45% available phosphate and 15% Calcium (Ca).
- I. Ammonium Sulfate (NH4)2SO4, (21-0-0 guaranteed analysis N-P2O5-K2O): Commercial product containing approximately 21% ammonia.
- J. Ammonium Nitrate NH4NO3, (34-0-0 guaranteed analysis N-P2O5-K2O): Commercial product containing approximately 34% ammonia.
- K. Calcium Nitrate CaNO3, (15.5-0-0 guaranteed analysis N-P2O5-K2O): Agricultural grade containing 15-1/2% nitrogen.
- L. Potassium Nitrate KNO3, (13-0-45 guaranteed analysis N-P2O5-K2O): Commercial product containing approximately 13% nitrogen and 45% potassium.
- M. Ureaformaldehyde (38-0-0 guaranteed analysis N-P2O5-K2O): Granular commercial product containing approximately 38% nitrogen.
- N. Urea CO(NH2)2, (46-0-0 guaranteed analysis N-P2O5-K2O): Granular commercial product containing 46% nitrogen.
- O. I.B.D.U. (Iso Butyldiene Diurea): Commercial product containing 31% nitrogen.

2.4 FERTILIZERS

- A. Composition: Nitrogen (N), phosphorous (P2O5), and potassium (K2O) content, plus other elements, as indicated.
- B. Palm Tree Fertilizer (pre-plant 9-3-9) <<<VERIFY>>>:
 - 1. Organic-based, long-lasting, controlled-release, uniform in composition, free flowing, granular- type fertilizer with micronutrients, suitable for application with approved equipment.
 - 2. Palm Fertilizer shall contain the following minimum available percentages by weight of plant food (pending results of soil analysis):

<i>Element/Material</i>	Targeted Property Range
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Nitrogen (N) - Slow Release	9.0% minimum
Phosphoric acid (as P2O5)	3.0% minimum
Potash (as K2O)	9.0% minimum
Calcium (Ca)	3.0% minimum
Magnesium (Mg)	4.0% minimum
Sulfur (S)	6.0% minimum
Iron (Fe)	2.0% minimum
Manganese (Mg)	0.05% minimum
Zinc (Z)	0.05% minimum
Humus	25.0% minimum
Humic Acids w/ micronutrients	5.0% minimum

3. Commercial-Grade Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
 - a. Gro-Power 9-3-9 Palm & Tropical with Micronutrients, Gro-Power, Chino, CA. 909-393-3744.
 - b. Or equal, as approved by the Landscape Architect.
4. Application Rate: Per Manufacturer’s current printed recommendation.

C. Turf Grass Starter Fertilizer (pre-plant 3-12-12), as required

1. General: Shall be applied for turf grasses planted from sod or seed (not hydroseed or hydrostolons).
2. Fertilizer shall be an organic-based, long-lasting, controlled-release, uniform in composition, free flowing granular-type fertilizer with micronutrients, suitable for application with approved equipment. Fertilizer shall be high in potassium and phosphorous elements to aid in strong root development.
 - a. Turf/Lawn Fertilizer shall contain the following minimum available percentages by weight of plant food (pending results of soil analysis):

<u>Element/Material</u>	<u>Targeted Property Range</u>
Nitrogen (N) Slow Release	3.0% minimum
Phosphoric acid (as P2O5)	12.0% minimum
Potash (as K2O)	12.0% minimum
Humus	35.0% minimum
Humic Acids w/ micro-nutrients and soil enhancers	7.0% minimum

3. Commercial-Grade Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
 - a. *Gro-Power 3-12-12 Flower & Bloom*, Gro-Power, Chino, CA. 909-393-3744.
 - b. Or equal, as approved by the Landscape Architect.
4. Application Rate: Twenty (20) pounds per 1,000 SF.

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D. Fertilizer Tablet:

1. General: Fertilizer Tablet shall be a 7-gram tablet, organic-based, tightly compressed chip-type commercial grade, 12-month slow-release planting tablets, and shall be composed of the following available percentages by weight of plant food:

<i>Element/Material</i>	<i>Targeted Property Range</i>
Nitrogen (N)	12.0% minimum
Phosphoric acid (as P ₂ O ₅)	8.0% minimum
Potash (as K ₂ O)	8.0% minimum
Humus	20.0% minimum
Humic Acids w/ micronutrients and soil enhancers	4.0% minimum

2. Commercial-Grade Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
 - a. *Gro-Power 12-8-8 Planting Tablets*, Gro-Power, Chino, CA 909-393-3744.
 - 1) Application Rate: As indicated herein Part III this Section.
 - b. Or equal, as approved by the Landscape Architect.

2.5 ACCESSORIES

- A. Wetting Agent/Water Storing Polymer: Non-biodegradable, granular, polyacrylamide polymer soil amendment.
 1. Commercial-Grade Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
 - a. *Broadleaf P4*, Broadleaf Industries, Inc. Chula Vista, CA (619)424-7880.
 - b. Or equal, as approved by the Landscape Architect.
- B. Perforated Drain Pipe & Drain Sock (Tree Chimney): Refer to Section 329400 – Landscape Planting Accessories.
- C. Landscape Mulch Material:
 1. Organic Wood Mulch: Refer to Section 329400 – Landscape Planting Accessories.
 2. Landscape Mulch Material for Submersible Planting Pots: Refer to Section 329400 – Landscape Planting Accessories.

PART 3 - EXECUTION

3.1 AGRONOMIC SOIL FERTILITY REPORT/RECOMMENDATION

Once rough grading has been accomplished, and prior to commencing Soil Preparation operations, (amendments, fertilizers, etc.), soil samples shall be taken from representative areas and below grade depths of the Project Site. Locations and depths to gather the representative soil samples shall be accomplished by the Contractor under the direction of the Landscape Architect.

1. Provide 2 Soil Samples.

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- B. Guidelines for Selecting the Soil Samples:
1. Select representative areas to sample. The area needs to be uniform in color, texture, depth, and drainage with the same fertilizing program and type of use. Planting areas to receive lawns, flowerbeds, trees, cut areas, fill areas, etc. should be tested separately. An area containing multiple trees and shrubs can be grouped into one area if the planting is the same.
 2. Depths and process of soil sampling:
 - a. Sample as deep as the soil will be amended, generally six-inches (6") deep for groundcover/lawns, eighteen-inches (18") deep for shrub areas, twenty-four-inches (24") deep for small boxed trees, and three-feet (3') to four-feet (4') for large boxed trees.
 - b. Use a soil probe or soil auger to remove a core sample; otherwise, use a shovel to dig a hole to the desired depth. Sample the soil from the side of the excavated hole, scraping the side with a trowel. The tools used for digging shall be clean and not rusty. Avoid sampling when the soil is too wet.
 3. In desired areas where multiple sub-samplings are taken from any one (1) area to create a combined sample, mix the sub-samples homogenously together in a clean plastic bucket prior to placing in the plastic bag.
 4. Each Sample shall be sent directly to the laboratory in a separate, re-sealable, one (1)-gallon plastic bag. Provide a minimum of four (4) cups of soil within each respective sample to allow for adequate testing.

3.2 SOIL PERCOLATION TESTING

- A. Type/Quantity: During operations of Agronomic Soil Fertility Testing and prior to installing Plant Material, Contractor shall perform Soil Percolation Tests, through the direction of the Landscape Architect, in selected representative areas of the Project Site, to verify acceptable natural drainage, soil structure, and soil composition. Contractor shall verify the locations of the Soil Percolation Tests with the Landscape Architect.
1. Required Number of Soil Percolation Tests: 1
- B. Procedure: Each Soil Percolation Test shall be performed as follows:
1. Dig a hole: 2'-0" wide x 2'-0" long x 2'-0" deep.
 2. Fill the hole with water to top and cover with plywood and barricade. Allow hole to drain and fill again to top.
 3. Make daily observations, noting the depth of water each day.
 4. Report findings, in writing, to the Landscape Architect. Include the length of time the water takes to drain completely from each hole, date of test, location, and other information, which may be useful in providing further recommendations.
- C. Results: Based on the combined results of the Agronomic Soil Fertility Testing and the Soil Percolation Tests, Contractor may be required to install additional tree drainage sumps or other drainage methods at each planting pit for trees larger than 15-gallon container stock. This does not relieve the Contractor's obligation within the Base Bid to provide the required Tree Root Aeration Units indicated in Section 329400 – Landscape Planting Accessories. Contractor shall include, as a line-item price within the Base Bid, the price per each additional tree drainage sump, should they be required (based on the testing). Should additional tree drainage sumps or other methods is required, compensation shall be awarded to the Contractor at the line-item price (each) as provided by the Contractor.

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3.3 SOIL MOISTURE CONTENT

- A. General: Do not work soil when moisture content is so great that excessive compaction occurs, or when it is so dry that dust will form in air, or that clods will not break readily. Apply water, if necessary, to bring soil to an optimum moisture content for tilling and planting. Soil moisture level prior to planting shall be no less than 75% of field capacity. The determination of adequate soil moisture for planting shall be the judgment of the Landscape Architect. Range: Maintain within two-percent (2%) above or below optimum moisture content at times during Work.

3.4 SITE CONDITIONS

- A. Contractor shall protect existing and new improvements and systems installed prior to planting installation. Maintain protection in place until completion of Work and contracted Landscape Establishment Period.
- B. Protect concrete paving, headers, and drainage from staining due to contact with wet nitrogen stabilized mulch/sawdust, or contact with chelated iron. Correct any stained concrete.

3.5 CLEARING & CULTIVATION

- A. Clearing: Clear planting areas free of stones two-inches (1”) in diameter and larger, weeds, debris, and other extraneous materials prior to soil preparation Work.
- B. Pre-Plant Weed Control:
 - 1. Clear and remove existing weeds by spraying and grubbing to at least one-inch (1”) below the soil surface.
 - 2. Dead weeds shall be cleared and removed prior to planting.
 - 3. Maintain a weed-free Project Site until final acceptance by the Owner, utilizing mechanical, chemical, or manual treatment.
- C. Cultivation of Native Site Soil and/or Spreading Imported Topsoil, with Amendments/Fertilizers:
 - 1. Verification: In planting areas where Imported Topsoil will be applied, verify that sub-grades prior to installation of Imported Topsoil have been established under rough grading. Do not spread Imported Topsoil prior to acceptance of sub-grade Work.
 - 2. Cultivation: Following Pre-Plant Weed Control operations, rip or cultivate verified planting areas of Native Site Soil at the indicated depth, prior to applying Imported Topsoil (if required) and Soil Amendments/Fertilizers.
 - a. Depth of Cultivation: minimum Ten-inches (10”).
 - 3. Following initial cultivation of existing Native Site Soil, evenly spread Imported Topsoil (if required) throughout all planting areas at the minimum indicated depth to meet finished landscape grades.
 - a. Depth of Imported Topsoil: Minimum six-inches (6”).
 - 4. Once Imported Topsoil has been spread, uniformly broadcast all required Soil Amendments and Fertilizers indicated in Planting Soil Amendments Schedule (below) as amended through the results of the Agronomic Soil Fertility Report.
 - 5. Thoroughly cultivate/blend all materials to provide a homogenous planting soil mixture at the indicated depth:
 - a. Depth of Cultivation: Minimum Ten-inches (10”).

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- 6. Tamp/compact prepared Planting Soil as required to eliminate settlement, and complete finish grading operations per Section 312219 – Landscape Grading.
- 7. Planting Soil Amendment Schedule:

<u>Soil Amendment/Fertilizer</u>	<u>Ratio</u>
First Component of Soil Conditioner Blend: Bulk Composted Organic Soil Amendment	Four (4) cu. yds. / 1,000 square feet of planting area.
Second Component of Soil Conditioner Blend: Granular Soil Conditioning Material & Fertilizer	At indicated ratio, per selected Manufacturer.
Gypsum	200 pounds / 1,000 square feet.
Commercial Fertilizer	At indicated ratio, per selected Manufacturer.
Soil Sulfur	8 pounds / 1,000 square feet of planting area.
Iron (non-staining)	10 pounds / 1,000 square feet of planting area.

- a. Modifications: The Planting Soil Amendment Schedule may be modified, based on the combined results of the Agronomic Soil Fertility Tests and Percolation Tests.
 - 1) Contractor shall be provided with fair and adequate compensation by the Owner should additions or increases to the specified ratios are required to the Planting Soil Amendment Schedule due to the Agronomic Soil Fertility Test results and/or recommendations by the Landscape Architect.
 - 2) Contractor shall provide the Owner fair and adequate credit should subtractions or decreases to the specified ratios are required to the Planting Soil Amendment Schedule due to the Agronomic Soil Fertility Test results and/or recommendations by the Landscape Architect.
- 8. Complete finish grading operations per Section 312219 – Landscape Grading.

3.6 APPLICATION RATES

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- A. Fertilizer Tablets shall be spread equidistantly around the perimeter within the Amended Planting Backfill Mixture, up to within three-inches (3”) of the finished grade of the Mixture, and at the following rates:

<i>Size of Plant Material</i>	<i>Total Quantity of 7-gram Fertilizer Tablets</i>
Liner, Plug, Flat-Size Plant, or 4” Pot.	One (1) Tablet
One (1)-gallon Container stock.	Three (3) Tablets
Five (5)-gallon Container stock.	Nine (9) Tablets
Fifteen (15)-gallon container stock	Fifteen (15) Tablets
24” Box Container Stock	Sixteen (16) Tablets
30” Box Container Stock	Eighteen (18) Tablets
36” Box Container Stock	Twenty (20) Tablets
42” Box Container Stock	Twenty-two (22) Tablets
48” Box Container Stock	Twenty-four (24) Tablets
60” Box Container Stock	Thirty-six (36) Tablets
For Container Stock larger than 60” Box.	Six (6) Tablets for each ½” of tree caliper size.
For each 1’-0” of Palm Tree (apical meristem) height. (Example: a 25’ Palm tree requires 50 tablets)	Two (2) Tablets.

- Contractor shall not provide Fertilizer Tablets for designated native plant species, as indicated in the Contract Drawings or as directed by the Landscape Architect. Contractor shall verify with the Landscape Architect, in writing, as to which plants are subject to not receive the Fertilizer Tablets.

B. Mycorrhizal Inoculum Application Rate:

- During application of Fertilizer/Planting Tablets, Mycorrhizal Inoculum shall be spread equidistantly around the perimeter within the Amended Planting Backfill Mixture, up to within three (3”) inches of the finished grade of the Mixture, at the prescribed application rate per the Manufacturer’s written recommendations.

3.7 DRAINAGE OF PLANTING AREAS

A. Surface Drainage:

- Discrepancies: Provide proper surface drainage of planted areas. Submit in writing all discrepancies in the Contract Drawings or Specifications, or prior Work done by others, which Contractor feels precludes establishing proper drainage.
- Correction: Include description of work required for correction or relief of said condition.

B. Detrimental Drainage, Soils and Obstructions:

- Notification: Submit in writing all soils or drainage conditions considered detrimental to growth of plant materials. State condition and submit proposal and cost estimate for correcting condition.
- Correction: Submit for acceptance a written proposal and cost estimate for the correction before proceeding with Work.

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3. Obstructions: If rock, underground construction Work, tree roots, or other obstructions are encountered in the performance of Work under this Section, submit cost required to remove the obstructions to a depth of not less than six-inches (6”) below the required soil depth.

3.8 CLEAN UP AND PROTECTION

- A. For Work under this Section, keep Work area in a clean, orderly, and safe condition. Contractor shall remove trash caused from his Work on a weekly basis throughout the duration of the Work.
- B. Protect site from damage due to landscape operations, operations by other Contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged Soil Preparation areas as directed.
- C. Upon completion of his Work under this Section, the Contractor shall remove rubbish, waste, debris, excess construction materials, and other items resulting from construction operations offsite as described herein this Section, as directed by the Landscape Architect.

END OF SECTION 329113 – SOIL PREPARATION

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SECTION 329200 – LAWNS & GRASSES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work, as required to make a complete Turf Grass and/or Ornamental Groundcover (via sown seed, stolon, plug, or sod) planting installation, as shown on the Contract Drawings, and as specified herein this Section.
- B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:
 - 1. Sodded Turf Grasses.
- C. Related Sections. The following Sections contain requirements that relate to Work in this Section:
 - 1. Section 328400 – Planting Irrigation.
 - 2. Section 329113 – Soil Preparation.
 - 3. Section 329300 – Exterior Plants.
 - 4. Section 329400 – Landscape Planting Accessories.
 - 5. Section 329813 – Landscape Establishment Period.

1.2 DEFINITIONS AND APPLICABLE STANDARDS

- A. References:
 - 1. ASPA – American Sod Producers Association.
 - 2. AOSA – Association of Official Seed Analysts.
- B. Definitions:
 - 1. Plant Material(s): Refers to living plant species, inclusive of turf grass (via sown seed, stolons, and/or sod), ornamental grasses or groundcovers (via sown seed or sown plugs) for the Project.
 - 2. Planting Area (PA): As denoted on the Contract Drawings, shall refer to areas to be installed with Plant Material(s), or areas where existing vegetation shall be protected.
- C. Measurements:
 - 1. SQ/FT: Measurement, in square-foot.

1.3 SUBMITTALS

- A. General:
 - 1. Collect information into a single Submittal for each element of construction and type of product identified under this Section for review.
 - 2. To expedite review, Submittal shall be organized and presented into specific sections or headings. Furnish neat, concise, legible, and clearly identifiable information, and

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sufficiently explicit detail, to enable proper evaluation for Contract compliance. Highlight catalog, product data, or brochures containing various products, sizes, and materials to show particular item submitted.

3. Submittal Format: As applicable, furnish Submittal as a single electronic digital PDF (Portable Document Format) file.

B. Digital Submittal Information:

1. Product Data: Manufacturer's current catalog cuts and specifications for materials included herein this Section.
2. Certifications:
 - a. Certificates of inspection as required by law for transportation of each shipment of plant material as required.
 - 1) Sod Certification: Certification of each seed mixture for sod, identifying sod source, including name and telephone number of supplier.
3. Qualification Data, for firms and persons specified in the "Quality Assurance and Control" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and address of architects and owners, and other information specified.
4. Meeting Notes from Pre-installation Conference.

- C. Submittals under this Article will be rejected and returned without the benefit of review by the Landscape Architect if they are difficult to read due to insufficient scale, poor image quality, or poor drafting quality; or if the required information is missing or not presented in the format as requested.

- D. No Work shall proceed under this Section until Submittal requirements indicated herein have been reviewed accordingly by the Landscape Architect.

1.4 QUALITY ASSURANCE & CONTROL

A. Installer Qualifications:

1. Requirement: Valid California C-27 (Landscaping Contractor) License.
2. Installer's Field Supervision: Installer to maintain an experienced full-time supervisor on the Project site during times that installations under this Section are in progress.

B. Plant Material Quality:

1. Refer to requirements under Part II herein this Section.

- C. Observation: Landscape Architect may observe installation Work herein this Section at Project Site for compliance with requirements for type, size, and quality. Landscape Architect retains right to observe installation of products for defects and to reject unsatisfactory or defective material or installation at any time during progress of Work. Contractor shall remove rejected Work immediately from Project site.

1.5 DELIVERY, STORAGE, AND HANDLING <<<SELECT AS NEEDED>>>

A. Sod:

1. Harvest and Delivery: Harvest Sod from the source and deliver to Project Site within 24 hours. Deliver only as much Sod as can be installed in one (1) day's work. Carefully

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handle Sod accordingly to the requirements of the ASPA's "*Specifications for Turfgrass, Sod Materials, and Transplanting/Installing*".

2. Review: Sod not transplanted within this time period shall be reviewed by the Landscape Architect prior to installation.

B. Granular Soil Conditioning Material & Fertilizer:

1. Delivery: Furnish material in unopened and undamaged Manufacturer's standard containers bearing original certification labels showing quantity, analysis and name of Manufacturer.
2. Storage: Protect material from weather or other conditions that would damage or impair the effectiveness of the product.

1.6 PROJECT SITE CONDITIONS

- A. General Requirements: Installation under this Section shall be performed only during the time of day and during seasons when satisfactory results can be expected, unless authorized by the Landscape Architect.
 1. Sod: Install immediately after finish grading and irrigation installation are accepted.
- B. Climate Restrictions: Do not install Plant Materials under this Section during rainy or inclement weather.

1.7 SUBSTITUTIONS

- A. Consideration: Materials to be considered equal to the Materials indicated herein this Section shall be reviewed by the Landscape Architect. Materials with equal performance characteristics produced by other Manufacturer's and/or Distributors may be considered, providing deviations in dimensional size, color, composition, operation, and/or other characteristics do not change the design concept, aesthetic appearance, nor intended performance, as solely judged by the Landscape Architect. The burden of proof on product equality is on the Contractor.
- B. Specific reference to Manufacturer's names and products specified herein are used as standards of quality. This implies no right to the Contractor to substitute other materials without prior written approval by the Landscape Architect for Work under this Section.
- C. Materials substituted and installed by the Contractor, without prior written approval by the Landscape Architect, may be rejected. Contractor shall not be entitled to be compensated by the Owner where the Contractor has installed rejected substitutions without receiving prior written approval.
- D. Contract Price: Substituted Materials under this Section shall not increase the Contract price.

1.8 WARRANTY

- A. Time Period: Warrant Plant Materials under this Section are established and in a healthy and flourishing condition of active growth six (6) months from date of Final Acceptance.
- B. Appearance During Warranty:

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1. Turf Grass areas shall be free of dead or dying patches, and shall show foliage of a normal density, size and color.
 2. Ornamental Grass areas shall be free of dead or dying patches, and shall show foliage of a normal density, size and color.
- C. Delays: Delays caused by the Contractor in completing planting operations under this Section which extend the planting into more than one (1) planting season shall extend the Warranty Period correspondingly.
- D. Coverage: Warrant growth and coverage of installations under this Section to the effect that a minimum of 95% of the area planted shall be covered and of acceptable appearance with the specified planting after one (1) growing season, with no bare spots.
1. Exceptions: Contractor shall not be held responsible for failures due to neglect by Owner, vandalism, or natural disaster during Warranty Period. Report such conditions in writing.
- 1.9 FINAL ACCEPTANCE AND LANDSCAPE ESTABLISHMENT PERIOD
- A. Refer to Section 329813 – Landscape Establishment Period.

PART 2 - PRODUCTS

2.1 TURF GRASS MATERIALS

- A. General:
1. Provide sodded installation of Turf Grass areas as designated on the Contract Drawings.
- B. Turf Grass Sod Material:
1. Provide certified Turf Grass Sod complying with ASPA's Specifications for thickness, size, strength, moisture content, and mowed height. Provide Sod of grass species and varieties selected, proportioned by weight, and minimum percentages of purity, germination, and maximum percentage of weed seed.
 2. Sod shall consist of live, growing, mature nursery-grown field stock, and shall arrive with a lush appearance, uniform texture, and a deep green color typical of the selected turf grass species.
 3. Sod shall be machine-cut from the nursery field with a minimum of one-half inch (1/2") of soil that completely covers the roots of the Sod. Sod shall contain a healthy, virile root system of dense, strong, thickly matted roots throughout, with no dead or dry edges, and capable of vigorous growth and development when planted. Sod shall be sufficiently dense to bear handling and placement without tearing.
 4. Sod shall be free of thatch, diseases, and harmful insects, and reasonably free from noxious or broadleaf weeds or other grasses, and shall not contain any other matter deleterious to its growth or which might affect its subsistence or hardiness when transplanted.
 - a. Sod shall be considered "weed free" if no more than ten (10) weeds are found per 100 SF of Sod.

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- b. Entire lot of Sod shall be rejected if found to contain the following weeds: common Bermuda grass, quackgrass, nutgrass, johnsongrass, poison ivy, nimbleweed, thistle, bindweed, bentgrass, perennial sorrel, or bromegrass.
5. Turf Grass Sod Species:
- a. Type: *Platinum te Paspalum*[™] Drought Tolerant Warm Season Grass. Daily activity levels, durable, hardy, coarse texture, up to 40% shade, mow at 2-1/2" to 3-1/2", dark-green color year-round.
 - b. Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
 - 1) West Coast Turf, Palm Desert, CA 760-340-7345.
 - 2) Or equal (no known equal).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
- 1. Grades: Verify that grades are within one-inch (1") plus or minus (+/-) of the required finished grades. Verify that applicable soil preparation and erosion control materials have installed under other Sections of the Contract Specifications. Report all variations in writing.
 - 2. Irrigation System: Verify that the irrigation system is installed and 100% coverage of the subject area is complete, tested, and in full working order. Complete installation of the irrigation system is a prerequisite for commencing work under this Section.
 - 3. Stones, Weeds, and Debris: Verify that planting areas under this Section are clear of stones larger than 1-1/2 in. diameter, and that weeds, debris and other extraneous materials have been removed prior to installation.

3.2 PREPARATION

- A. Limit sub-grade preparation to areas that will be planted in the immediate future.
- B. Excessive Soil Moisture: Do not commence Work under this Section when Soil Moisture Content is so great that excessive compaction to the soil will occur during installation. Owner and/or Landscape Architect shall be the sole judges as to a acceptable soil moisture content.
- C. Inadequate Soil Moisture: Apply water, in quantity as necessary, to bring soil to a optimum moisture content for installation under this Section. Do not work soil when it is so dry that dust will form in air or where clods will not readily break apart.
- D. Cultivation of Slopes: Planting areas of 2:1 slopes and greater shall be ripped or cultivated to a depth of three inches (3") immediately prior to hydroseeding. Refer to Section 329113 – Soil Preparation.
- E. Erosion Control Fabric: Refer to Section 329400 – Landscape Planting Accessories.

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- F. Contractor's Option: Perform manual hand seeding, machine, or hydro-mulching of planting areas.

3.3 TURF GRASS SOD INSTALLATION

- A. Delivery: Sod slabs shall be delivered on pallets and installed at the Project Site within twenty-four (24) hours after harvesting. Sod not installed within this time period shall be inspected and approved or rejected by the Landscape Architect. Do not lay sod if dormant.
- B. Protection: Protect root system of the sod from exposure from the weather, including dehydration, contamination, and heating during transportation to the site and delivery. In hot, dry, or windy weather conditions, stacked sod at the Project Site shall be lightly sprinkled with water to prevent sod slab edges from drying out.
- C. Allowance Period for Soil Settlement: Turf Grass Sod installation shall be started only after soil preparation and finish grading has been completed and soil has been permitted to settle under full irrigation during deep-water leaching operations for a minimum of two (2) weeks.
- D. After Allowance Period of Soil Settlement has expired, the areas to be sodded shall be loosened to a depth of two-inches (2”), raked, and floated to the final finished grade by a standard acceptable method. Finished areas shall be kept moist, even, and smooth, free from ridges and depressions, rocks, debris, and dirt clods, and reasonably well firmed.
- E. Compaction and Final Grading: Contractor shall provide sod beds that will not “footprint. Lightly rake and roll soil with two-hundred (200) pound water-ballast roller (filled 1/3 – 1/2 full), and bring level firm to finish grade. Final rolling shall be at right angles to slopes to prevent erosion. Sub-soil finish grade shall be sufficiently below the final grade to allow for the thickness of the sod material. Where applicable, newly sodded areas shall blend and match with existing turf grass areas so as to produce a smooth, unified field of turf grass.
- F. Application of Fertilizer: Apply the Pre-plant Starter Fertilizer evenly throughout the area to be sodded, at the prescribed application rate. Evenly distribute fertilizer by applying equal quantities in two (2) directions at right angles to each other.
- G. Raking: After broadcasting starter fertilizer, lightly rake and smooth seed bed surface to 1/4 in. depth. Install sod immediately thereafter, provided the sod bed has remained in a friable condition.
- H. Sodding Operations:
 1. Lay sod to form a solid mass with tightly fitted butt joints, with “green-side up”.
 2. Starter Strip: Lay first row of sod in a straight line, with subsequent rows parallel to and tightly against each other.
 3. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads (in a running-bond-type pattern) to offset joints in adjacent courses.
 4. Avoid damage to sub-grade or sod during installation.
 5. Tamp and roll lightly to ensure full contact with sub-grade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
 6. Lay sod parallel to the lay of the sodded area. Lay sod across angle of slopes exceeding 3:1, beginning at the bottom of slope area.

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7. Anchor sod on slopes exceeding 6:1 with wood stakes spaced at two (2) pegs per square yard. Provide not less than two (2) anchors per sod strip to prevent slippage.
 8. Cutting: Use a sharp knife to cut sod to fit straight segments or curves (and apertures in "turfblock" paving). Trim sod in straight lines when planting beds are linear or parallel to the hardscape elements. Trim sod slabs in a smooth, continuous curve when sod edges are placed against curvilinear hardscape elements.
 9. Mulch Ring at Sod in Turf Grass Areas: Trim sod in clean diameter circles around the perimeter of trees planted in turf grass areas, as indicated on the Contract Drawings. The Mulch Ring circles shall have the tree trunk located in the middle of the circle. Provide Organic Wood Mulch in these areas, at the designated thickness specified herein this Section.
 10. Sod in Grass Paving: Thoroughly press sod into grass paving with walk-behind type vibrator roller. Leave 1/2 in. soil above top of rings after compaction.
- I. Initial Watering: Saturate sod with fine water spray within two (2) hours of planting. Do not lay entire amount of sod before beginning watering. Water in lightly, when a relatively large area of sod has been placed.
1. During first week, water daily to supplement rainfall as necessary to maintain moist soil to a minimum depth of two-inches (2") below the sod until sod has rooted. Repeat watering at regular intervals until sod has established itself.
 2. Once established, decrease the watering frequency and increase the amount of water per application.
- J. Protection on Site: Erect temporary barricades, warning signs & flags, as required. Protect the sodded areas against vehicular and pedestrian traffic until sodded areas have established growth to the satisfaction of the Owner or Landscape Architect.
- K. Sod Establishment:
1. Mow and maintain turf height recommended by the turf grass nursery. Do not cut more than 40% of the total grass blade length in one (1) single mowing.
 2. Replace dead or dying sod with new sod.
 3. Eradicate weeds between second and third mowing. Apply herbicides uniformly at the Manufacturer's recommended rate.
 4. Apply a second application of the Pre-plant Starter Fertilizer uniformly to the surface at the Manufacturer's recommended application rate thirty (30) days after seeding.
 5. Dispose of protective barricades and warning signs at the termination of the sod establishment period.
 - 6.

3.4 OVERSEEDING SODDED TURF GRASS

- A. Preparation: Prepare Sodded Turf Grass bed to receive overseeding installation. Following verticutting/mowing, scarification, and dethatching, apply seed.
- B. Turf Grass Seeding Operations (via Hand Seeding or Mechanical Spreader):
1. Restrictions: Do not broadcast seed when winds exceed fifteen (15) mph.
 2. Mechanical Seeder: Sow evenly with an accepted mechanical seeder/culti-packer that covers the seed and forms the seedbed in one (1) operation.
 3. Sowing Seeds:
 - a. Broadcast half of the seed mix, evenly distributed over entire seed bed.

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- b. Broadcast remaining half of seed mix at right angles to first pattern, using same method.
 4. Areas inaccessible to mechanical culti-packer: Hand broadcast seed and rake seeded ground with flexible rakes. Do not change finish grades. Roll seeded area with roller weighing 150 lbs. per foot of roller width.
 5. Peat Humus: Dust on 1/4 in. thick layer of Peat Humus uniformly over seeded bed.
 6. Top-dress Fertilizer: Evenly apply at the rate indicated per the manufacturer's latest printed instructions, per 1,000 square feet, at 25 days and at 50 days after seeding.
- C. Initial Watering: Water with fine spray until seed bed is moistened to a depth of four-inches (4"). Do not use a jet nozzle or permit disturbance of surface of seed bed.
 1. During first week, water daily to supplement rainfall as necessary to maintain moist soil to a minimum depth of two-inches (2") below the surface until seed has germinated. Repeat watering at regular intervals until seed has thoroughly and adequately established itself.
 2. Protect seeded areas against hot, dry weather or drying winds. Apply supplemental water, in quantity as required, under these adverse conditions.
 3. Once established, decrease the watering frequency and increase the amount of water per application, as required to maintain adequate growth.
- D. Protection of Site: Erect temporary barricades, warning signs & flags, as required, protecting seeded areas against vehicular and pedestrian traffic until seeded areas have established growth to the satisfaction of the Owner or Landscape Architect.

3.5 FIELD QUALITY CONTROL

- A. Tests: Samples of materials may be taken and tested for conformity to the Contract Specifications at any time by the Landscape Architect.
- B. Rejected Materials: Remove rejected materials immediately from the site at Contractor's expense. Pay cost of testing of materials not meeting the Contract Specifications.
- C. Intent: A consistent, thriving, and even cover of installed seed, sod, stolons, plugs, or hydro-mulching materials is the intent of this Section.
- D. Satisfactory Installation Performance Standards:
 1. Turf Grass Seed: A consistent, thriving, and even cover of installed seeding materials is the intent of this Section. At the end of the Landscape Establishment Period, a healthy, uniform, close stand of seeded turf grass has been established, free of weeds and surface irregularities, at 100% percent full coverage with no bare spots. Provide additional seed, as required, to meet design intent. Failure to comply with this requirement shall extend the Landscape Establishment Period accordingly until the requirement is met.
 2. Turf Grass Sod: A consistent, thriving, and even cover of installed sod materials is the intent of this Section. At the end of the Landscape Establishment Period, a healthy, uniform, close stand of sodded turf grass has been established, free of weeds and surface irregularities, at 100% percent full coverage with no bare spots. Provide additional sod, as required, to meet design intent. Failure to comply with this requirement shall extend the Landscape Establishment Period accordingly until the requirement is met.
 3. Hydro-Mulching Applications: At the end of the Landscape Establishment Period, a healthy, uniform, close stand of hydro-mulched plant material has been established, free

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of weeds and surface irregularities, with coverage exceeding 95% percent coverage with no bare spots exceeding 6” inches. Failure to comply with this requirement shall extend the Landscape Establishment Period accordingly until satisfactory installation requirements are met.

3.6 CLEANING

- A. Hydro-mulching Overspray: Upon completion of hydro-mulching operations, clean off any slurry overspray from drainage devices, paving surfaces, plant materials, and site or architectural features. Contractor shall exercise caution in cleaning these areas so as not to wash away previously hydro-mulched areas (as applicable).
- B. Erosion: Immediately restore eroded areas. Keep adjacent paved surfaces cleaned of dirt, mud or stains and organic debris.

END OF SECTION

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SECTION 329300 – EXTERIOR PLANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work, as required to make a complete Exterior Landscape Planting installation, as shown in the Contract Drawings, and as specified herein this Section.
- B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:
 - 1. Trees.
 - 2. Shrubs.
 - 3. Ground Covers.
 - 4. Cacti, Succulents, etc.
 - 5. Perennials.
- C. Related Sections: The following Sections contain requirements that relate to Work in this Section:
 - 1. Section 025639 – Temporary Tree and Plant Protection.
 - 2. Section 312219 – Landscape Grading.
 - 3. Section 328400 – Landscape Irrigation.
 - 4. Section 329113 – Soil Preparation.
 - 5. Section 329200 – Lawns and Grasses.
 - 6. Section 329400 – Landscape Planting Accessories.
 - 7. Section 329813 – Landscape Establishment Period.

1.2 DEFINITIONS AND APPLICABLE STANDARDS

- A. References:
 - 1. ASTM – American Society for Testing Materials.
 - 2. USDA – United States Department of Agriculture.
 - 3. ANSI – American National Standards Institute.
- B. Reference Standards:
 - 1. *An Annotated Checklist of Woody Ornamental Plants of California, Oregon, and Washington*, (Number 4091), McClintock and Leiser, Division of Agricultural Sciences, University of California, 1979.
 - 2. *American National Standard for Nursery Stock (ANSI Z60.1)*. American National Standards Institute, and American Association of Nurserymen, Latest edition,
 - 3. *American Joint Committee on Horticultural Nomenclature*, 1942 Edition of Standardized Plant Names.
 - 4. *Hortus III*, 1976 Edition, Liberty Hyde Bailey Hortorium, Cornell University.
 - 5. *The Hillier Gardener's Guide to Trees and Shrubs*, 4th Edition, 1978.
 - 6. *Manual of Cultivated Conifers*, Den Ouden & Boon, 1978.

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7. *Datascape Guide to Commercial Nomenclature*, American Nurserymen Publishing Co., Chicago, IL, 1994.
8. *American National Standard for Tree Care Operation, Tree, Shrub, and Other Woody Plant Maintenance (ANSI A300)*, American National Standards Institute, Latest Edition.

C. Definitions:

1. *Plant Material(s)* – Refers to living plant species, inclusive of trees, shrubs, groundcovers, vines, ornamental grasses, cacti/succulents, espaliers, annuals, perennials, etc., as indicated in the Contract Drawings.
2. *Planting Area (PA)* – As denoted on the Contract Drawings, shall refer to areas to be installed with Plant Material(s), or areas where existing vegetation shall be protected.
3. *Plant Height* – Measurement of main body height, not measurement to branch tip.
4. *Plant Spread* – Measurement of main body diameter, not measurement from branch tip to branch tip.
5. *Amended Planting Backfill Mixture* – Refer to Section 329113 – Soil Preparation.
6. *Balled and Burlapped Stock* – Healthy, vigorous exterior plants with firm, natural balls of earth in which they are grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum laced as recommended by ANSI Z60.1.
7. *Balled and Potted Stock* – Healthy, vigorous exterior plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of exterior plant required.
8. *Bare-Root Stock* – Healthy, vigorous exterior plants grown with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for type and size of exterior plant required.
9. *Clump* – Where three or more young trees were planted in a group and have grown together as a single tree having three or more main stems or trunks.
10. *Container-Grown Stock* – Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of exterior plant required.
11. *Fabric Bag-Grown Stock* – Healthy, vigorous, well-rooted exterior plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of exterior plant.
12. *Finish Grade* – Elevation of finished surface of planting soil.
13. *Manufactured Topsoil* – Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
14. *Multi-Stem* – Where three (3) or more main stems arise from the ground from a single root crown or at a point right above the root crown.
15. *Sub-grade* – Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.
16. *Subsoil* – All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

D. Measurements:

1. sq/ft or SF: Measurement, in square-foot.
2. O.C.: Measurement used for On-Center spacing.

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1.3 SUBMITTALS

A. General:

1. Collect information into a single Submittal for each element of construction and type of product or equipment identified under this Section for review.
2. To expedite review, Submittal shall be organized and presented into specific sections or headings. Furnish neat, concise, legible, and clearly identifiable information, and sufficiently explicit detail, to enable proper evaluation for Contract compliance. Highlight catalog, product data, or brochures containing various products, sizes, and materials to show particular item submitted.
3. Submittal Format: As applicable, furnish Submittal as a single electronic digital PDF (Portable Document Format) file.

B. Digital Submittal Information:

1. Alphabetized List of Plant Material.
2. Planting Installation Schedule:
 - a. Provide anticipated site area(s) and dates of installation for each type of planting.
3. Qualification Data, for firms and persons specified in the "Quality Assurance and Control" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and address of architects and owners, and other information specified.
4. Meeting Notes from Pre-installation Conference.
5. Description of Plant Material, for each species indicated in the Contract Drawings, submitted in the following format:

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<p>(Provide Color Photograph of Plant Material here)</p> <p>(Note: Photograph shall include a person, tape measurer, or other scaled reference).</p>	
<i>Project Name:</i>	
<i>Botanical Name:</i>	
<i>Common Name:</i>	
<i>Form (Multi, Standard, etc.):</i>	
<i>Container Size (as applicable):</i>	
<i>Overall Height (provide Apical Meristem Height for Palms):</i>	
<i>Spread:</i>	
<i>Caliper (as applicable):</i>	
<i>Quantity Required (per Contract Drawings):</i>	
<i>Quantity Available (at supplying Nursery):</i>	
<i>Supplying Nursery Name:</i>	
<i>Contact Name at Nursery:</i>	
<i>Nursery Address:</i>	
<i>Nursery Phone Number:</i>	
<i>Date of Nursery Photo:</i>	
<i>Comments/Remarks:</i>	

- 6. The Alphabetized List of Plant Material and Description of Plant Material shall not be construed as to acceptance of the Plant Material. All Plant Material shall be subject to review and approval by the Landscape Architect upon delivery to the Project Site.

- C. Submittals under this Article will be rejected without the benefit of review by the Landscape Architect if they are difficult to read due to insufficient scale, poor image quality, or poor drafting quality; or if the required information is missing or not presented in the format as requested.

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- D. No Work shall proceed under this Section until Submittal requirements indicated herein have been reviewed accordingly by the Landscape Architect.

1.4 QUALITY ASSURANCE AND CONTROL

- A. Installer Qualifications:
 - 1. Requirement: Valid California C-27 (Landscaping Contractor) License.
 - 2. Engage an experienced Installer who has demonstrated completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.
 - 3. Installer's Field Supervision: Installer shall maintain an experienced full-time supervisor on the Project site during times that landscaping installations under this Section are in progress.
- B. Plant Material: Provide quality, size, genus, species, and variety of Plant Material indicated, complying with applicable requirements of ANSI Z60.1 "American Standard for Nursery Stock."
 - 1. Selection of Plant Material purchased under allowances will be made by the Owner, who has the option to tag Plant Material stock at their place of growth before they are prepared for transplanting.
 - 2. At least one (1) plant of each Plant Material species delivered to the Project Site shall have an identification tag from supplying nursery showing botanical and common name of the plant as identified in the Contract Drawings. Landscape Architect shall be provided the opportunity for an on-site debriefing by the Contractor that identifies the size and specific type of Plant Material upon delivery.
 - 3. Incorrect Planting Materials:
 - a. Replace, at no cost to Owner, Plant Material that is revealed during the course of the Contract as to being untrue to the species indicated in the Contract Drawings and reviewed accordingly under this Section.
 - b. Provide replacements equal to the size and quality to match the planted materials at the time the untrue species is discovered.
 - 4. Replacement of Plant Material: Refer to the Guarantee Article indicated herein this Section.
- C. Observation: Landscape Architect may observe Plant Materials at their place of growth (nursery), at the site before or after planting, or both, for compliance with requirements for genus, species, variety, size and quality. Landscape Architect also retains right to observe Plant Material further for size and condition of root balls, trunks, branches, and crowns; insects; pests; disease; weeds; injuries, and latent defects. Landscape Architect reserves the right to reject unsatisfactory and/or defective Plant Material at any time during progress of Work. Contractor shall remove rejected Plant Material immediately from Project site.
- D. Regulatory Requirements:
 - 1. Contractor shall meet the requirements of applicable laws, codes, and regulations as required by the authorities having jurisdiction over the Work.
 - 2. Provide for inspections and permits by Federal, State, and Local authorities in furnishing, transporting, and installing materials.
- E. Permits, Fees, Bonds, and Inspections: Contractor shall arrange and pay for permits, fees, bonds, and inspections necessary to perform and complete Work under this Section.

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- F. Plant Material Review and Selection (Tagging):
1. At the discretion of the Landscape Architect, Plant Material will be subject to review, photographed, and selected/tagged by the Landscape Architect at the nursery, or other place of growth, prior to delivery to the Project Site. Contractor shall verify with the Landscape Architect if tagging operations are required.
 2. Selecting/Tagging of Plant Materials at the nursery or place of growth does not cancel the right of the Landscape Architect to reject Plant Materials at the Project Site, if damaged or unacceptable conditions are found that were not detected at the nursery, place of growth, or in the submitted photographs.
- G. Plant Material Delivery: Plant Material shall be delivered with original Plant Material tagging materials set in place, as selected and marked by the Landscape Architect at the nursery or place of growth. Contractor shall notify Landscape Architect upon deliver of Plant Material for review of stock and tagging materials. Plant Materials delivered without original tagging materials, or with broken, damaged, or altered tagging materials, shall be subject to rejection by the Landscape Architect. Rejected Plant Material shall be removed immediately.
- H. Pre-installation Conference: Conduct conference at Project Site to comply with requirements of Division 1 Section "Project Meetings".
- I. Protection of Existing Plant Material:
1. Refer to Requirements specified in Section 025639 – Temporary Tree and Plant Protection.
 2. It is the intent of the Contract Documents that certain existing Plant Materials shall be retained. Prior to the removal of any Plant Materials, the Contractor shall confer with the Landscape Architect to determine which Plant Materials are to remain.
 3. All existing Plant Materials which are to remain in the project shall be tagged and identified by the Contractor prior to start of Work.
 4. Contractor shall be responsible for Plant Materials that are designated to remain. Damage to any Plant Materials which results in death or permanent disfiguration of said Materials shall result in compensation outlined in Section 025639 – Temporary Tree and Plant Protection. The Landscape Architect shall be the sole judge of the condition of the Plant Materials.
 5. Existing Plant Materials designated to remain shall be protected at all times from damage by construction activity (tools, materials, equipment, personnel, etc.). Damage by the Contractor to existing Plant Materials shall be repaired at the Contractor's expense to the satisfaction of the Owner, as directed by the Landscape Architect.
 6. Contractor shall insure that no foreign material and/or liquid, such as paint, concrete, cement, oil, turpentine, acid or the like, be deposited or allowed to be deposited on soil within the drip line (the outside edge of the foliage overhang) of any Plant Material. Do not store construction materials, debris, or excavated material within drip line of existing Plant Material. Should any such poisoning of the soil occur, the Contractor shall thoroughly remove said soil as directed by the Landscape Architect and replace with acceptable soil at no additional cost to the Owner.
 7. Excavation adjacent to existing Plant Materials: Where it is necessary to excavate in close proximity to the drip lines of existing Plant Materials, all possible caution shall be exercised to avoid injury to roots and trunk. Excavation close to Plant Materials shall be done by hand, with narrow-tine spading forks or other approved tools to comb soil to expose roots. Tunnel under roots two-inches (2") and larger in diameter. Cutting of roots two-inches (2") and larger shall be only on the approval of the Landscape Architect.
 8. Replacement of Damaged Plant Material: Replace existing Plant Material to remain as required, hat are damaged by Contractor during construction with accepted Plant Material

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of the same species, size, and quantity as those damaged, at no additional cost to Owner. Owner shall be the sole judge as to the extent of the damage and the value of said damaged Plant Material.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. General: Do not prune Plant Material before delivery, except as approved by the Landscape Architect. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie Plant Material in such a manner as to destroy natural shape.
 - 1. Immediately after digging field-grown Plant Materials, pack root systems in wet straw, hay, burlap, or other suitable material to keep root system moist until final planting installation.
 - 2. Deliver freshly dug field-grown Plant Materials with firm, natural balls of earth of sufficient depth to include fibrous and feeding roots, meeting or exceeding requirements of ANSI Z60.1 for root ball diameter.

- B. Handling Plant Materials:
 - 1. Handle balled and burlap Plant Material stock by the root ball.
 - 2. Handle container-grown Plant Materials only by their containers.
 - 3. DO NOT handle Plant Materials by their trunks or stems.
 - 4. DO NOT drop any Plant Materials.
 - 5. DO NOT bind or handle Plant Materials with wire or rope.
 - 6. Pad trunk and branches of Plant Materials whenever using hoisting cables, chains, or straps.
 - 7. Should the Contractor engage in handling any Plant Material(s) by any unacceptable method(s), the Landscape Architect shall reserve the right to reject any of the mishandled Plant Material(s). The Contractor shall replace rejected Plant Material(s) with approved Plant Material(s), at no additional cost to the Owner.

- C. Delivery: Provide protective covering during delivery. Deliver Plant Material only after preparations for planting have been completed and install immediately. If planting is delayed more than six (6) hours after delivery, set Plant Materials in shade, protect from weather and mechanical damage, and keep roots moist. Anchor plants to prevent damage from winds.
 - 1. Heel-in bare-root Plant Material stock. Soak roots in water for two (2) hours prior to planting.
 - 2. Set balled Plant Material stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
 - 3. DO NOT remove container-grown Plant Material stock from containers before time of planting.
 - 4. Water root systems of Plant Material stored on site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.6 COORDINATION, SCHEDULING, AND OBSERVATIONS

- A. Acceptance: Do not install Plant Materials prior to acceptance of finish grades and installation of irrigation system.

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- B. Utilities: Determine location of above grade and underground utilities and perform Work in a manner which will avoid damage to utilities. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.
- C. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, cease planting operations and notify Landscape Architect for further direction.
- D. Construction Site Observations: Landscape Architect may observe installation Work herein this Section at Project Site for compliance with requirements for type, size, and quality. Landscape Architect retains right to observe installation of products and materials for defects and to reject unsatisfactory or defective product, material, or installation at any time during progress of Work. Contractor shall remove rejected Work immediately from Project site. Contractor shall request, in writing, at least one (1) week in advance of the time when mandatory site observation(s) by the Landscape Architect are required.

1.7 PROJECT SITE CONDITIONS

- A. General: Installation of Plant Materials shall be performed only during the time of day and during seasons when satisfactory results can be expected, unless authorized by the Landscape Architect.
- B. Climate Restrictions: Do not install Plant Materials during rainy or inclement weather.

1.8 SUBSTITUTIONS

- A. Consideration: Plant Materials to be considered equal to the Plant Materials indicated herein this Section shall be reviewed by the Landscape Architect. Plant Materials with equal performance characteristics may be considered, providing deviations in dimensional size, color, composition, operation, and/or other characteristics do not change the design concept, aesthetic appearance, or intended performance, as solely judged by the Landscape Architect. The burden of proof on product equality is on the Contractor.
 - 1. Substituted Plant Materials shall be true to species and variety and shall conform to measurements specified, except that plants larger than specified may be used if accepted. If larger Plant Materials are accepted, increase the ball of earth in proportion to the size of the plant, as required. Plant Materials overgrown for their container size will be rejected.
- B. Specific reference to Manufacturer's names and products specified herein are used as standards of quality. This implies no right to the Contractor to substitute other materials without prior written approval by the Landscape Architect for Work under this Section.
- C. Plant Materials substituted and installed by the Contractor, without prior written approval by the Landscape Architect, may be rejected. Contractor shall not be entitled to be compensated by the Owner where the Contractor has installed rejected substitutions without receiving prior written approval.
- D. Contract Price: Substituted Plant Materials under this Section shall not increase the Contract price.

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1.9 WARRANTY

- A. General: The Warranty indicated herein in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract, and shall be in addition to, and run concurrent with, other guarantees or warranties made by the Contractor under requirements of the Contract Documents.
- B. Warranty: Contractor shall warrant living Plant Materials under this Section for a period of one (1) year after date of Substantial Completion. Warrant against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by the Owner; abnormal weather conditions unusual for the Warranty Period; or incidents which are beyond the Contractor's control.
- C. Replacement of Plant Material:
 - 1. Replace Plant Materials exhibiting conditions which are determined to be unacceptable due to workmanship by the Contractor, at no cost to the Owner, per the direction of the Landscape Architect.
 - 2. Remove and replace dead or dying Plant Material immediately unless required to plant in the succeeding planting season.
 - 3. Contractor shall be held responsible for a maximum of two (2) replacement of each failed Plant Material after Final Acceptance during the Warranty Period.
 - a. Closely match replacements to adjacent specimens of the same species. Apply requirements of this Specification to replacements.

1.10 FINAL ACCEPTANCE AND LANDSCAPE ESTABLISHMENT PERIOD

- A. Refer to Section 329813 – Landscape Establishment Period.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PLANT MATERIAL

- A. Immediately upon award of Contract for Work in this Section, Contractor shall locate and purchase or hold for purchase plant material as required.
 - 1. Contractor shall verify with Landscape Architect of Plant Material that has been nursery “contract grown” by the Owner for use of Work under this Contract.
 - 2. Contractor shall review the condition of the Plant Material with Landscape Architect at the nursery maintaining the Plant Material prior to delivery, and when delivered to the Project Site.
- B. Quality: Plant Materials shall have a growth habit typical for each variety and species indicated in the Plant List (as detailed on the Contract Drawings).
 - 1. All Plant Materials specified shall be superior/premium-grade nursery stock, full, densely foliated, symmetrical, with tightly knit branching, so trained or favored in development and appearance in form, number of branches, compactness and symmetry, healthy, and vigorous in growth, as reviewed and determined by the Landscape Architect.

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2. Plant Materials shall be free from insect pests, eggs and larvae, plant diseases, sun scalds, fresh bark abrasions, excessive abrasions, windburn, salt burn, weeds, or other disfigurements or conditions, as reviewed and determined by the Landscape Architect.
 3. Plant Material shall be subject per the California State Department of Agriculture's Regulations for Nursery Inspections of Rules and Grading.
 4. Growing Conditions: Plant Materials shall be nursery-grown in accordance with good horticultural practices under climatic conditions similar to those of project unless otherwise specifically authorized.
- C. Container Stock (excluding annuals) shall be grown in boxes or containers in which delivered for at least one (1) growing season, but not over two (2) years. Plant Material grown in boxes or containers shall be cultivated during this time to permit full rooting within the specified box or container to bind the planting soil, but not so long as to create a "root-bound" condition.
1. Plant Material shall be completely free of circling, kinked or girdling trunk surface and center roots, and show no evidence of a pot-bound condition.
 2. No boxed nor container Plant Material shall be planted which have cracked or broken balls of earth when separated from their boxes or containers.
 3. No Plant Material shall be planted with damaged roots, broken root balls, or which are found to be "root-bound" when separated from their containers.
- D. Pruning:
1. Do not prune Plant Materials unless directed by the Landscape Architect.
 2. Pruning of Plant Material as grown at the nursery shall conform to ANSI A300 standards.
 3. Consult with Landscape Architect for pruning Plant Materials after delivery and installation.
- E. Measurements: Measure Plant Material according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes.
1. Take caliper measurement at a point on the trunk six-inches (6") above natural ground line for trees up to four-inches (4") in caliper (at a point twelve-inches (12") above the natural ground line for trees over four-inches (4") in caliper).
 - a. Measure foliage across mean foliage dimension when branches are in their normal upright position.
 - b. For trees to be supplied in "raised up" condition, foliage origin along main trunk shall be measured from soil line after installation.
 - c. Height and spread dimensions specified refer to main body of plant and not branch tip to tip. Properly trimmed plants shall measure the same in any direction. If a plant is unevenly grown, it shall be classified in the size category of the smallest dimension.
 2. Size Range: If a range of size is given, do not use Plant Materials less than the minimum size. The measurements specified are the minimum size acceptable and are the measurements after pruning, where pruning is required. Plant Materials that meet the measurements specified, but do not possess a normal balance between height and spread shall be rejected.
- F. Field Dug Stock: Prior to digging of field-grown Plant Materials, insure that excess loose fill resulting from cultivation around trunks/stems and over roots be removed down to natural finish grade at crown of Plant Materials. During digging, verify that size of tree spade or other equipment is adequate to encompass the actively growing root zone of all Plant Materials. Plant Materials which, after digging, show mostly large fleshy roots and few fibrous roots, will be rejected.

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- G. Condition of Root Systems: Plant Materials must prove to be completely free of circling, kinked or girdling trunk surface and center roots and show no evidence of a root-bound condition. Upon inspection by Landscape Architect at the job site, if five-percent (5%) or more of the plants of each species are found to contain kinked, circling or girdling roots, all plants of that species shall be rejected.
- H. Unacceptable Trees: Trees that have damaged, broken, pruned, or crooked leaders will be rejected. Trees having a main leader shall not have been headed back. Trees with abrasions of the bark, sunscalds, disfiguring knots, or fresh cuts of limbs over 3/4 in. which have not completely callused will be rejected.

2.2 SHADE AND FLOWERING TREES

- A. Shade and Flowering Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, conforming to ANSI Z60.1 for type of trees required, subject to review and acceptance by the Landscape Architect. Container-grown trees will be acceptable and shall be subject to meeting ANSI Z60.1 limitations for container stock.
 - 1. Branching Height: 1/2 of tree height, unless otherwise indicated on Contract Drawings.
- B. Small Trees: Small upright or spreading type, branched or pruned naturally according to species and type, and with relationship of caliper, height, and branching recommended by ANSI Z60.1, subject to review and acceptance by the Landscape Architect. Container-grown trees will be acceptable and shall be subject to meeting ANSI Z60.1 limitations for container stock.
 - 1. Form: As indicated on the Contract Drawings for individual selected species.

2.3 SHRUBS

- A. Form and Size: Shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of Shrub, subject to review and acceptance by the Landscape Architect. Container-grown Shrubs will be acceptable in lieu of balled and burlapped.
 - 1. Container-grown Shrubs shall be subject to meeting ANSI Z60.1 limitations for container stock, and other requirements as indicated on the Contract Drawings.

2.4 BROADLEAF EVERGREENS

- A. Form and Size: Normal-quality, well-balanced, well-rooted , broadleaf evergreens, of type, height, spread, and shape required, subject to review and acceptance by the Landscape Architect.
 - 1. Container-grown broadleaf evergreens shall be subject to meeting ANSI Z60.1 limitations for container stock, and other requirements as indicated on the Contract Drawings.

2.5 GROUND COVERS

- A. Provide ground covers full, established, and well-rooted in removable flats, containers, or integral peat pots, and with not less than the minimum number and length of runners required by ANSI Z60.1 for the container size indicated, and other requirements as indicated on the Contract Drawings, subject to review and acceptance by the Landscape Architect.

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2.6 CACTI/SUCCULENTS

- A. Form and Size: Superior-quality, established, full, symmetrical, well-balanced, well-rooted, of type, height, spread, and shape required, subject to review and acceptance by the Landscape Architect.
 - 1. Container-grown stock shall be subject to meeting ANSI Z60.1 limitations for container stock.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. NO WORK UNDER THIS SECTION SHALL COMMENCE UNTIL SUBMITTALS UNDER THIS SECTION HAVE BEEN REVIEWED ACCORDINGLY BY THE LANDSCAPE ARCHITECT.
- B. Prior to commencing Work under this Section, Contractor shall examine previously installed Work from other trades and verify that such Work is complete and to the point where Work herein may commence properly. Do not proceed with Work until unsatisfactory conditions have been corrected.
- C. Installation practices of the Plant Materials shall be performed during those periods when weather and soil conditions are suitable and in accordance with locally accepted horticultural practices, as judged by the Landscape Architect.
 - 1. Soil moisture levels prior to planting shall be no less than seventy-five-percent (75%) of field capacity. The determination of adequate soil moisture for planting shall be in the sole judgment of the Landscape Architect, and their decision shall be final.
 - a. If the soil moisture level is found to be insufficient for planting installation, planting pits shall be filled with water and allowed to drain before commencing planting operations.
 - b. Any planting area that may become compacted in excess of eighty-five-percent (85%) relative compaction (due to construction operations or other activities during the Contract) shall be tilled and thoroughly cross-ripped to a minimum depth of nine-inches (9") to alleviate the condition, taking care to avoid all existing subsurface utilities, drainage, etc.
 - c. Do not commence planting installation prior to acceptance of Section 329113 – Soil Preparation.
- D. Contractor shall notify the Landscape Architect, in writing, on the anticipated commencement date and length of duration of the landscape installation.
- E. Preparation of Planting Installation: Lay out individual Plant Material locations and areas for multiple plantings. Stake locations, outline areas, and gain the Landscape Architect's acceptance prior to commencing physical planting installation.
- F. At the discretion of the Landscape Architect, Contractor shall make field adjustments to the planting layout, as required, per the direction of the Landscape Architect. Layout changes made accordingly shall be performed at no additional cost to the Owner.

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- G. No more Plant Materials shall be distributed in the planting area on any day than can be installed and watered on that day. Plant Materials shall be planted and watered immediately after the removal of their containers, as applicable.
- H. Contractor shall protect existing and new improvements and systems installed prior to planting installation. Maintain protection in place until completion of Work and Landscape Establishment Period.
- I. Finish Grades for planting areas shall have been established (per Section 312219 – Landscape Grading) prior to Work under this Section. Verify that grades are within one-inch plus or minus (1”+/-) of the required finish grade, and that all proper soil amendments and fertilizers have been furnished and installed accordingly as specified (per Section 329113 – Soil Preparation).
 - 1. Maintain positive surface drainage of all planted areas throughout the duration of the Contract.
- J. Pre-Planting: Where Plant Materials are to be pre-planted to permit site improvements to be installed around them, Contractor shall be responsible for the accurate layout and placement of those Plant Materials, as measured to their centerlines. Confirm designated pre-planting operations with Landscape Architect prior to commencing Work. Contractor shall also be responsible for the protection of pre-planted Plant Materials while other Work is taking place around them. Provide regular irrigation, as necessary, prior to installation and functioning of irrigation systems (per Section 328400 – Irrigation Systems).

3.2 EXCAVATION FOR PLANT MATERIAL

- A. General: Upon completion of applicable pre-planting soil preparation requirements indicated in Section 329113 – Soil Preparation, excavate planting hole(s) for Plant Material with scarified vertical sides, with the bottom of the excavated hole slightly raised and compacted at the center to assist drainage and to minimize settlement of the Plant Material. Excavate holes according to the spacing alignment (i.e. hedge spacing, grid spacing, triangular spacing, etc.) and the on-center (O.C.) spacing intervals (i.e. 24” O.C. etc.) indicated on the Contract Drawings. Loosen any hard subsoil in the bottom of the excavation where evident, and remove all rocks greater than one-half-inch (1/2”) in diameter, trash, debris, etc. Retain the excavated soil for use as part of the Amended Planting Backfill Mixture (as indicated in Section 329113 – Soil Preparation).
 - 1. Bare-Root Plant Material:
 - a. Excavate at least twenty-four-inches (24”) wider than the perimeter of the bare root spread, and deep enough to allow setting of the roots on a compacted layer of native planting soil, where the top of the plant’s root collar is one-inch (1”) higher than finished grade or as further directed by the Landscape Architect:
 - b. Compacted Setting Layer: Provide a crown of a minimum six-inch (6”) depth of native planting soil.
 - c. Where Tree Root Aeration Units are indicated (per Section 329400 – Landscape Planting Accessories), provide further excavation in the planting hole by auger to the required minimum depth allowing for installation of the Tree Root Aeration Unit assembly.
 - 2. Balled and Burlap Plant Material:
 - a. Excavate the planting hole to the width and depth indicated in the Contract Drawings. Depth of the planting hole includes the depth indicated for the compacted setting layer at the bottom of the excavation, where the top of the plant’s root collar

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- is one-inch (1”) higher than finished grade or as further directed by the Landscape Architect:
- b. Compacted Setting Layer: Provide a crown of a minimum six-inch (6”) depth of native planting soil.
 - c. Where Tree Root Aeration Unit(s) are indicated (per Section 329400 – Landscape Planting Accessories provide further excavation in the planting hole by auger to the required minimum depth allowing for installation of the Tree Root Aeration Unit assembly.
3. Container-Grown Plant Material:
- a. Excavate the planting hole to the width and depth indicated on the Contract Drawings. Depth of the planting hole includes the depth indicated for the compacted setting layer at the bottom of the excavation, where the top of the plant’s root collar is one-inch (1”) higher than finished grade or as further directed by the Landscape Architect:
 - b. Compacted Setting Layer: Provide a crown of a minimum six-inch (6”) depth of native planting soil.
 - c. Where Tree Root Aeration Unit(s) are indicated, (per Section 329400 – Landscape Planting Accessories), provide further excavation in the planting hole by auger to the required minimum depth for installation of the Tree Root Aeration Unit assembly.
- B. Obstructions: Notify the Landscape Architect immediately if unexpected rock, debris, contaminants, obstructions, or other items that are detrimental to the healthy sustained growth of Plant Material is encountered in the excavation process.
1. Hardpan Layer: If encountered, drill six-inch (6”) diameter holes into free-draining strata or to a depth of ten-feet (10’), whichever is less, and backfill with free-draining material.
- C. Drainage: Notify the Landscape Architect if subsoil conditions show evidence of unexpected water seepage or retention in planting holes.

3.3 PLANTING PLANT MATERIAL

- A. Bare Root Plant Material: Set Bare Root Plant Material plumb and in center of the excavated hole, with top of root ball set properly at the adjacent finish grade as indicated. Set Bare Root Plant Material in the proper spacing and/or alignment(s) as indicated on the Contract Documents, or as further directed at the Project Site by the Landscape Architect.
1. Thoroughly soak the roots of the Bare Root Plant Material in clean water for a minimum of twelve (12) hours but no more than twenty-four (24) hours to fully hydrate the root mass. Do not soak above the root crown.
 2. Remove wood shavings or other material used to keep the exposed root mass in a moist condition.
 3. Carefully place the Plant Material stock on the specified setting layer of compacted native soil, with the top of root mass set approximately one-inch (1”) above the finished grade to allow for settlement of the Plant Material within the excavated planting hole. Provide an orientation of the Plant Material that is confirmed and acceptable by the Landscape Architect. During the process of determining an acceptable orientation of the Plant Material, carefully handle the Plant Material by its trunk.
 4. Prepare the Amended Planting Backfill Mixture: Amend each cubic yard (cu/yd) of native soil excavated from the planting hole by incorporating and thoroughly mixing/blending the following:

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- a. ¼ yard of Bulk Composted Organic Soil Amendment Material (per Section 329113 – Soil Preparation).
 - b. ½ pound of Granular Soil Conditioning Material & Fertilizer (per Section 329113 – Soil Preparation).
 - c. Add Mycorrhizal Inoculum to the excavated native soil, (per Section 329113 – Soil Preparation), per the Manufacturer’s latest printed instructions.
 - 1) Pending the results of the Agronomic Soil Fertility Report, the Amended Planting Backfill Mixture may be modified accordingly to include additional soil amendments or fertilizers (gypsum, iron, potash, etc.) or the ratios as indicated in the Mixture indicated above may be modified.
 - a) The cost of providing modifications to the Amended Planting Soil Backfill Mixture (as recommended through the Agronomic Soil Fertility Report and as directed by the Landscape Architect) shall be borne by the Contractor.
 5. Install the Tree Root Aeration Unit(s) prior to backfilling operations, as required (per Section 329400 – Landscape Planting Accessories).
 6. Backfilling the excavated planting hole:
 - a. Place the Amended Planting Backfill Mixture around the Plant Material root mass in the excavated planting hole. Place the Mixture in six-inch (6”) lifts, tamping each lift accordingly to settle the Mixture and eliminate voids and air pockets.
 - b. Maintain the Plant Material plumb while working the Mixture around the root mass. When the planting hole is approximately half-backfilled, water thoroughly before placing the remainder of the Mixture.
 - c. Add the Fertilizer Tablets and other amendments, (per Section 329113 – Soil Preparation) as required, at the prescribed application rates (as indicated per Section 329113 – Soil Preparation) or if not indicated, per the Manufacturer’s latest printed instructions.
 - d. Place the final layers of the Amended Planting Backfill Mixture, tamping accordingly, to the top of the root mass.
 - e. Dish and tamp top of the Mixture to form a three-inch (3”) deep watering basin centered on the Plant Material’s trunk to the rim width of the planting hole.
 - f. Thoroughly mix together water and Plant Vitamin/Hormone Stimulant in application ratio as recommended by Stimulant Manufacture (per Section 329400 – Landscape Planting Accessories). Apply liquid matrix in sufficient quantity to thoroughly saturate the basin to settle the Mixture, and to eliminate voids and air pockets. Should any portions of the root mass be exposed, add additional Mixture as needed to thoroughly cover the root mass.
 7. Mulching: Apply mulch in watering basins as indicated on the Contract Drawings. Refer to Section 329400) – Landscape Planting Accessories for type and requirements.
- B. Balled and Burlapped Plant Material: Set the Balled and Burlapped Plant Material plumb and in center of the excavated hole, with top of the root ball raised above adjacent finish grade as indicated. Set Balled and Burlapped Plant Material in the proper spacing and/or alignment(s) as indicated on the Contract Documents, or as further directed at the Project Site by the Landscape Architect.
1. Carefully place the Balled and Burlapped Plant Material stock on the specified setting layer of compacted native soil, with the top of root ball set one-inch (1”) above the finished grade to allow for settlement of the Plant Material within the excavated planting hole. Provide the orientation of the Plant Material that is confirmed and accepted by the Landscape Architect. During the process of determining an acceptable orientation of the Plant

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- Material, handle the Plant Material by its root ball; avoid handling the Plant Material by its trunk.
2. Once orientation is accepted, carefully remove the burlap and wire baskets from the tops of the root ball and partially from the sides, but do not remove from under the root ball. Do not damage the root ball or any part of the plant. Plant Material shall be rejected if the root ball is cracked or broken before or during the planting operation.
 3. Prepare the Amended Planting Backfill Mixture: Amend each cubic yard (cu/yd) of native soil excavated from the planting hole by incorporating and thoroughly mixing/blending the following:
 - a. $\frac{1}{4}$ yard of Bulk Composted Organic Soil Amendment Material (per Section 329113 – Soil Preparation).
 - b. $\frac{1}{2}$ pound of Granular Soil Conditioning Material & Fertilizer (per Section 329113 – Soil Preparation).
 - c. Add Mycorrhizal Inoculum to the excavated native soil, (per Section 329113 – Soil Preparation), per the Manufacturer’s latest printed instructions.
 - 1) Pending the results of the Agronomic Soil Fertility Report, the Amended Planting Backfill Mixture may be modified accordingly to include additional soil amendments or fertilizers (gypsum, iron, potash, etc.) or the ratios as indicated in the Mixture indicated above may be modified.
 - a) The cost of providing modifications to the Amended Planting Soil Backfill Mixture (as recommended through the Agronomic Soil Fertility Report and as directed by the Landscape Architect) shall be borne by the Contractor.
 4. Install the Tree Root Aeration Unit(s) prior to backfilling operations, as required (per Section 329400 – Landscape Planting Accessories).
 5. Backfilling the excavated planting hole:
 - a. Place the Amended Planting Backfill Mixture around the root ball in the excavated planting hole. Place the Mixture in six-inch (6”) lifts, tamping each lift accordingly to settle the Mixture and eliminate voids and air pockets.
 - b. Maintain the plant plumb while working the Mixture around the root ball. When the planting hole is approximately half-backfilled, water thoroughly before placing the remainder of the Mixture.
 - c. Add the Fertilizer Tablets and other amendments, (per Section 329113 – Soil Preparation) as required, at the prescribed application rates indicated herein this Article or if not indicated, per the Manufacturer’s instructions.
 - d. Place the final layers of the Mixture, tamping accordingly, to the top of the root ball. Do not place the Mixture on top of the root ball.
 - e. Dish and tamp top of the Mixture to form a three-inch (3”) deep watering basin centered on the Plant Material’s trunk to the rim width of the planting hole. Do not cover the top of the root ball with the backfill mixture.
 - f. Thoroughly mix together water and Plant Vitamin/Hormone Stimulant in application ratio as recommended by Stimulant Manufacture (per Section 329400 – Landscape Planting Accessories). Apply liquid matrix in sufficient quantity to thoroughly saturate the basin to settle the Mixture, and to eliminate voids and air pockets. Should any portions of the root mass be exposed, add additional Mixture as needed to thoroughly cover the root mass.
 6. Mulching: Apply mulch in watering basins as indicated on the Contract Drawings. Refer to Section 329400 – Landscape Planting Accessories for type and requirements.
- C. Container-Grown Plant Material: Set Container-Grown Plant Material plumb and in the center of the excavated planting hole, with top of the root ball raised above adjacent finish grade as

indicated. Set Container-Grown Plant Material in the proper spacing and/or alignment(s) as indicated on the Contract Documents, or as further directed at the Project Site by the Landscape Architect.

1. For plastic container stock (4" pot, 1-gallon, 5-gallon, 15-gallon, etc.), carefully remove the plant container prior to setting the plant in the excavated hole so as not to damage root ball. Tip container to horizontal position and shake carefully to remove Plant Material. Support root ball during installation to prevent cracking or shedding of soil.
2. Set the Plant Material stock on the specified setting layer of compacted native soil, with the top of root ball set one-inch (1") above the finished grade to allow for settlement of the Plant Material within the excavated planting hole. Provide the orientation of the Plant Material that is confirmed and accepted by the Landscape Architect. During the process of determining an acceptable orientation of the plant material, carefully handle the Plant Material by its container; avoid handling the Plant Material by its trunk.
 - a. Plant Material with a damaged root ball upon removal of the container, or if the root ball fails to thoroughly hold the soil as it is removed from the container, or if the plant is mishandled or damaged during planting operations, shall be rejected.
3. For wooden boxed container stock, carefully set whole boxed container of the Plant Material stock on the specified setting layer of compacted native soil, with the top of root ball set one-inch (1") above the finished grade to allow for settlement of the Plant Material within the excavated planting hole. Provide the orientation of the Plant Material that is confirmed and accepted by the Landscape Architect. During the process of determining an acceptable orientation, carefully handle the Plant Material by its container; avoid handling the Plant Material by its trunk or branches. Once orientation is accepted, remove the steel strapping and the sides of the wooden container so as not to damage the root ball or any part of the plant. Do not remove the bottom of the wooden container. Discard sides.
 - a. Plant Material with a damaged root ball upon removal of the container, or if the root ball fails to thoroughly hold the soil as it is removed from the container, or if the plant is mishandled or damaged during planting operations, shall be rejected.
4. Scarification: After removing container from plant, scarify the sides of the root ball to a depth of one-inch (1") at four (4) to six (6) equally-spaced locations around the perimeter of the root ball or at twelve-inch (12") intervals on sides of wooden boxed container stock. Cut and remove circling roots over 3/8 in. diameter.
5. Prepare the Amended Planting Backfill Mixture: Amend each cubic yard (cu/yd) of native soil excavated from the planting hole by incorporating and thoroughly mixing/blending the following:
 - a. ¼ yard of Bulk Composted Organic Soil Amendment Material (per Section 329113 – Soil Preparation).
 - b. ½ pound of Granular Soil Conditioning Material & Fertilizer (per Section 329113 – Soil Preparation).
 - c. Add Mycorrhizal Inoculum to the excavated native soil, (per Section 329113 – Soil Preparation), per the Manufacturer's latest printed instructions.
 - 1) Pending the results of the Agronomic Soil Fertility Report, the Amended Planting Backfill Mixture may be modified accordingly to include additional soil amendments or fertilizers (gypsum, iron, potash, etc.) or the ratios as indicated in the Mixture indicated above may be modified.
 - a) The cost of providing modifications to the Amended Planting Soil Backfill Mixture (as recommended through the Agronomic Soil Fertility Report and as directed by the Landscape Architect) shall be borne by the Contractor.
6. Install the Tree Root Aeration Unit(s) prior to backfilling operations, as required (per Section 329400 – Landscape Planting Accessories).

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7. In areas where indicated on the Contract Drawings, install the Deep Watering Bubblers as part of the irrigation system.
8. Backfilling the excavated planting hole:
 - a. Place the Amended Planting Backfill Mixture around the root ball in the excavated planting hole. Place the Mixture in six-inch (6") lifts, tamping each lift accordingly to settle the Mixture and eliminate voids and air pockets. Foot tamp the backfill, as required.
 - b. Maintain the plant plumb while working the Mixture around the root ball. When the planting hole is approximately half-backfilled, water thoroughly before placing the remainder of the Mixture.
 - c. Add the Fertilizer Tablets and other amendments (per Section 329113 – Soil Preparation) as required, at the prescribed application rates indicated herein this Article or if not indicated, per the Manufacturer's instructions.
 - d. Place the final layers of the Mixture, tamping accordingly, to the top of the root ball. Do not place the Mixture on top of the root ball.
 - e. Dish and tamp top of the Mixture to form a three-inch (3") deep watering basin centered on the Plant Material's trunk to the rim width of the planting hole. Do not cover the top of the root ball with the backfill mixture.
 - f. Thoroughly mix together water and Plant Vitamin/Hormone Stimulant in application ratio as recommended by Stimulant Manufacture (per Section 329400 – Landscape Planting Accessories). Apply liquid matrix in sufficient quantity to thoroughly saturate the basin to settle the Mixture, and to eliminate voids and air pockets. Should any portions of the root mass be exposed, add additional Mixture as needed to thoroughly cover the root mass.
9. Mulching: Apply mulch in watering basins as indicated on the Contract Drawings. Refer to Section 329400 – Landscape Planting Accessories for type and requirements.

D. Plant Settling and Orientation: Plant Material that has settled deeper than the surrounding grade shall be excavated and raised to the correct level, to the satisfaction of the Landscape Architect. Plant Material installed without direction and/or approval as to its proper orientation shall be subject to excavation and acceptable orientation, to the satisfaction of the Landscape Architect.

E. Fertilizer Tablet(s) Application Rate: Refer to Section 329113 – Soil Preparation.

3.4 PLANTING GROUND COVERS

A. General: Upon completion of applicable pre-planting soil preparation requirements indicated in Section 329113 – Soil Preparation, excavate planting hole(s) for Ground Covers and/or Vine Plant Material with scarified vertical sides, with the bottom of the excavated hole slightly raised and compacted at the center to assist drainage and to minimize settlement of the Plant Material. Refer to requirements indicated in Part III of this Section for Excavation.

1. Plant Settling: Plant Material that has settled deeper than the surrounding grade shall be raised to the correct level.

B. Excavate holes according to the spacing alignment (i.e. triangular spacing, etc.) and the on-center (O.C.) spacing intervals (i.e. 24" O.C. etc.) indicated on the Contract Drawings. Loosen any hard subsoil in the bottom of the excavation where evident, and remove all rocks greater than one-half-inch (1/2") in diameter, trash, debris, etc.

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- C. Obstructions: Notify the Landscape Architect immediately if unexpected rock, debris, contaminants, obstructions, or other items that are detrimental to the healthy sustained growth of Plant Material is encountered in the excavation process.
- D. Ground Covers: Follow applicable planting requirements per Articles 3.02 and 3.03 indicated herein this Section.
 - 1. Carefully set root mass into excavated hole, spreading roots, and backfill with planting soil.
 - 2. Add Fertilizer Tablets and other amendments, as required, within backfill.
 - 3. Work soil around roots to eliminate air pockets, and provide a slight saucer indentation around plants to retain surface water.
 - 4. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

3.5 PRUNING PLANT MATERIAL

- A. At no time shall Plant Material be pruned, trimmed, thinned, shaped, or topped prior to delivery. Pruning, trimming, thinning, shaping, or topping of Plant Material shall be only conducted on the Project Site, and under the presence and direction of the Landscape Architect or approved Certified Arborist. Plant Material that has been pruned and delivered to the Project Site without prior approval by the Landscape Architect or an approved Certified Arborist will be rejected.
- B. When directed by the Landscape Architect or an approved Certified Arborist, Contractor shall prune, thin, and shape plant material, according to standard horticultural practice, to preserve the natural character of the Plant Material.
 - 1. Pruning and remedial work shall be done per ANSI A300.
 - 2. Prune trees to retain required height and spread. Do not cut tree leaders; remove only injured or dead branches from trees.
 - 3. Prune shrubs accordingly to retain natural character.
 - 4. Provide pruning, cabling and bracing, irrigation, pest and disease control and other remedial treatments as recommended to assure the long-term health of the trees and existing vegetation, and the safety of persons and property.
 - 5. Newly planted trees shall be pruned near the termination of the Landscape Establishment Period, per the direction of the Landscape Architect, as required.

3.6 CLEAN UP AND PROTECTION

- A. During installation operations, keep Work area in an orderly and safe condition. Contractor shall remove trash caused from his Work on a weekly basis throughout the duration of the Work.
- B. Protect landscaping from damage due to landscape operations, operations by other Contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.
- C. Upon completion of his Work under this Section, the Contractor shall remove rubbish, waste, debris, excess construction materials, surplus soil and other items resulting from construction operations and legally dispose of it off the Owner's property.
- D. Scars, ruts, or other marks in the ground caused by the Contractor's Work shall be repaired.

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- E. Remove equipment and implements of service, and leave the entire Project Site area in a neat, clean, and Owner-approved condition.
- F. Labels: Remove all nursery-type labels, flags, and or identification markings from Plant Materials.

3.7 FINAL REVIEW

- A. Final Review under this Section shall be performed upon completion of the Landscape Establishment Period. Refer to Section 329813 – Landscape Establishment Period, for requirements.

END OF SECTION

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SECTION 329400 – LANDSCAPE PLANTING ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work, as required to make a complete exterior Landscape Planting Accessories installation, as shown in the Contract Drawings, and as specified herein this Section.
- B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:
 - 1. Mulches (wood products).
 - 2. Weed Control Barrier / Geotextile Filter Fabric.
 - 3. Miscellaneous Materials (Herbicides, Vitamin Stimulant/Root Hormone, etc.).
- C. Related Sections: The following Sections contain requirements that relate to Work in this Section:
 - 1. Section 312219 – Landscape Grading.
 - 2. Section 328400 – Irrigation Systems.
 - 3. Section 329113 – Soil Preparation.
 - 4. Section 329200 – Lawns & Grasses.
 - 5. Section 329300 – Exterior Plants.
 - 6. Section 329813 – Landscape Establishment Period.

1.2 DEFINITIONS AND APPLICABLE STANDARDS

- A. References:
 - 1. ASTM – American Society for Testing and Materials.
 - 2. ANSI – American National Standards Institute.
- B. Definitions: (Not Used).
- C. Measurements:
 - 1. PSI: Measurement, in pounds per square inch.
 - 2. CU/FT: Measurement, in cubic-foot.
 - 3. PPM: Measurement, in parts per million.

1.3 SUBMITTALS

- A. General:
 - 1. Collect information into a single Submittal for each element of construction and type of product or equipment identified under this Section for review.
 - 2. To expedite review, Submittal shall be organized and presented into specific sections or headings. Furnish neat, concise, legible, and clearly identifiable information, and sufficiently explicit detail, to enable proper evaluation for Contract compliance.

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Highlight catalog, product data, or brochures containing various products, sizes, and materials to show particular item submitted.

3. Submittal Format: As applicable, furnish Submittal as a single electronic digital PDF (Portable Document Format) file.

B. Digital Submittal Information:

1. Product/Material Data. Submit available product/material literature supplied by manufacturer's, indicating that their products comply with specified requirements. Provide manufacturing source (name, address, and telephone number), and distributor source (name, address, and telephone number) for each type of product/material.
2. Qualification Data: Submit names for firms and persons specified in the "Quality Assurance and Control" Article to demonstrate their capabilities and experience on similar Landscape Planting Accessories installations.

C. Material Samples: Submit four (4) sets of physical Material Samples for review of kind, color, pattern, size, and texture for a check of these characteristics with other elements, and for a comparison of these characteristics between Submittal and actual component as delivered and installed. Include the full range of exposed color and texture expected in the completed Work. Provide Material Samples bound and individually wrapped in re-sealable labeled 1-gallon plastic bags (as applicable):

1. 0.50 cubic foot of Landscape Mulch Material (Shredded Wood Mulch).
2. One (1) two-foot (2'-0") long section of Tree Root Aeration Unit assembly.
3. One (1) two-foot (2'-0") long sample of Root Control Barrier.
4. One (1) set of Tree Tying/Staking Materials for each type used, as applicable.
5. One (1) set of Tree Guying Materials for each type used, as applicable.
6. One (1) two-foot (2'-0") square sample of Weed Control Barrier / Geotextile Filter Fabric for each type used, as applicable.

D. Scaled Shop Drawings: Not Required.

E. Field-Constructed Mock-ups: Not Required.

F. Submittals under this Article will be rejected and returned without the benefit of review by the Landscape Architect if they are difficult to read due to insufficient scale, poor image quality, or poor drafting quality; or if all of the required information is missing or not presented in the format as requested. Partial Submittals will not be accepted.

G. No Work shall proceed under this Section until Submittal requirements indicated herein have been reviewed accordingly by the Landscape Architect.

1.4 QUALITY ASSURANCE AND CONTROL

A. Installer Qualifications:

1. Requirement: Valid California C-27 (Landscaping Contractor) License.
2. Engage an experienced Installer who has completed Landscape Planting Accessories work similar in material, design, and extent to that indicated for this Project and with a record of successful installation.
3. Installer's Field Supervision: Installer shall maintain an experienced full-time supervisor on the Project site during times that installations under this Section are in progress.

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- B. Observation: Landscape Architect may observe installation of Landscape Planting Accessories at Project Site for compliance with requirements for type, size, and quality. Landscape Architect retains right to observe Landscape Planting Accessories for defects and to reject unsatisfactory or defective material at any time during progress of Work. Contractor shall remove rejected Accessories immediately from Project site.
- C. Manufacturer's Directions: Follow Manufacturer's directions and drawings in cases where the Manufacturers of articles used in this Section furnish directions covering points not shown in the Contract Drawings and Contract Specifications.
- D. Permits, Fees, Bonds, and Inspections: Contractor shall arrange and pay for permits, fees, bonds, testing services, and inspections necessary to perform and complete Work under this Section.
- E. Single-Source Responsibility: Obtain each color, type, and variety of products/materials from a single source with resources to provide products/materials of consistent quality in appearance and physical properties without delaying Work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Provide new, unused materials indicated under this Section. Store and secure properly to prevent theft or damage. Deliver and store perishable material in original, unopened packaging. It is the responsibility of the Contractor to install "factory condition" Units.
- B. Damaged Materials: Be responsible for all damage or disfiguration of Work until Final Acceptance. Remove off site and replace at no additional cost to Owner all damaged or rejected materials.
- C. Deliver materials so as to not delay Work, and install only after preparations for installation have been completed.

1.6 COORDINATION, SCHEDULING, AND OBSERVATIONS

- A. Utilities: Determine location of above grade and underground utilities and perform Work in a manner which will avoid damage to utilities. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.
- B. Excavation: When conditions detrimental to installing Landscape Planting Accessories are encountered, such as rubble fill, adverse drainage conditions, or obstructions, cease installation operations and notify Landscape Architect for further direction.
- C. Field Measurements: Contractor shall take field measurements as required. Report major discrepancies between the Contract Drawings and field dimensions to the Landscape Architect prior to commencing Work.
- D. Installation: Perform installation of Landscape Planting Accessories only when weather and soil conditions are suitable in accordance with locally accepted practices.

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- E. Construction Site Observations: Contractor shall request, in writing, at least one (1) week in advance of the time when mandatory site observation(s) by the Landscape Architect are required.

1.7 SUBSTITUTIONS

- A. Consideration: Materials to be considered equal to the Materials indicated herein this Section shall be reviewed by the Landscape Architect. Materials with equal performance characteristics produced by other Manufacturer's and/or Distributors may be considered, providing deviations in dimensional size, color, composition, operation, and/or other characteristics do not change the design concept, aesthetic appearance, nor intended performance, as solely judged by the Landscape Architect. The burden of proof on product equality is on the Contractor.
- B. Specific reference to Manufacturer's names and products specified herein are used as standards of quality. This implies no right to the Contractor to substitute other materials without prior written approval by the Landscape Architect for Work under this Section.
- C. Materials substituted and installed by the Contractor, without prior written approval by the Landscape Architect, may be rejected. Contractor shall not be entitled to be compensated by the Owner where the Contractor has installed rejected substitutions without receiving prior written approval.
- D. Contract Price: Substituted Materials under this Section shall not increase the Contract price.

1.8 LANDSCAPE ESTABLISHMENT PERIOD

- A. Refer to Section 329813 – Landscape Establishment Period, for requirements under this Article.
 - 1. During the duration of the Landscape Establishment Period, continuously maintain Landscape Planting Accessories by tightening, holding plumb, and/or repairing Staking and/or Guying supports, providing adequate depths and coverage requirements of Landscape Mulching Materials, monitoring drainage within Tree Root Aeration Units, hold Edging Materials true and in proper alignments, and other requirements, as required, to establish healthy, viable landscape planting materials until Final Acceptance of Work is granted.

PART 2 - PRODUCTS

2.1 LANDSCAPE MULCH MATERIALS

- A. Shredded Wood Mulch: Shredded Wood Mulch, free from deleterious materials, debris, and weed seed. Suitable as a top dressing of trees, shrubs and groundcovers, consisting of following:
 - 1. Type: Shredded cedar, redwood, fir, or hardwood commercial wood bark products, composted with humus and leaf materials. Shredded Wood Mulch shall be graded and to average dimensions of one-inch (1") to three-inches (3") in length, and flat in cross-section.
 - a. Minimum organic matter content at 80%.

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- b. pH between 5.0 and 8.0.
- c. Salt content shall be less than 4 millimho/cm @ 25 ° C. on a saturated paste extract.
- d. Boron content of the saturated extract shall be less than 1.0 parts per million.
- e. Calcium carbonate shall not be present.
- f. Carbon:Nitrogen ratio is less than 100:1.
- g. Compost shall be aerobic without malodorous presence of decomposition products.
- h. Maximum particle size shall be 2 inches. A maximum of 5% shall pass a No. 2 screen.

<i>Maximum Total Permissible Pollutant Concentrations (in parts per million (PPM)) on a dry weight basis:</i>	
Arsenic	20 ppm
Molybdenum	30 ppm
Cadmium	15 ppm
Nickel	50 ppm
Chromium	150 ppm
Selenium	25 ppm
Cobalt	50 ppm
Silver	10 ppm
Copper	150 ppm
Vanadium	50 ppm
Lead	150 ppm
Zinc	150 ppm
Mercury	10 ppm

- 2. Coverage Depth:
 - a. Refer to Part 3 indicated herein this Section.
- 3. Products & Manufacturer’s: Subject to compliance with requirements, provide products by one (1) of the following:
 - a. *ES-2 Mulch*, Agromin Horticultural Products.
 - b. *Pacific Mulch™*, Greenways Environmental.
 - c. *Walk-On Chips*, Earthworks Soil Amendments, Inc.
 - d. *Landscape Mulch*, Agri Service, Inc.
 - e. *Red Fir Bark*, Greenway Compost.
 - f. *A-1 Oak Deco Chips*, Hanson Aggregates/A-1 Soils.
 - g. *#SBM 3, Special Mulch #3*, Plants Choice, Inc.
 - h. Or equal, as approved by the Landscape Architect.

2.2 WEED CONTROL BARRIER/GEO-TEXTILE FILTER FABRIC

- A. Type: Permeable, lightweight, continuous, non-woven, geo-textile polypropylene filament material, UV-resistant, engineered to allow water permeability and deter soil permittivity, per ASTM D4491. Geo-Textile Filter Fabric shall be inert to biological degradation and resistant to naturally encountered chemicals, alkalis and acids. Meet AASHTO M288-96, Class 1.
- B. Products & Manufacturer’s: Subject to compliance with requirements, provide products by one (1) of the following:

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1. *Amoco 4553*, Amoco Fabrics and Fibers Company.
2. *FX-80HS*, Carthage Mills.
3. *C-80NW*, Contech.
4. *180 EX*, Linq.
5. *Geotex 801*, Propex, Inc.
6. *TerraTex N08*, Webtec.
7. *180N*, TC Mirafi.
8. *3301*, Typar Landscape Products.
9. Or equal, as approved by the Landscape Architect.

2.3 MISCELLANEOUS MATERIALS

- A. Water: Per ASTM C94, from potable domestic source, and free from deleterious materials such as oils, acids, and organic matter. Transport as required.
- B. Stress Reducing Agent: 100% natural organic root and plant stimulator solution, used to eliminate transplant shock and provide better establishment of plants. Solution shall contain a natural wetting agent, designed to improve nutrient release, water-holding capacity, cation exchange capacity in soil, and stimulate fertilizer and micronutrient uptake.
1. Products & Manufacturer's: Subject to compliance with requirements, provide products by one (1) of the following:
 - a. *Roots NoBurn®*, Novozymes Biologicals, Inc., Salem, VA.
 - b. *Essential® Plus 1-0-1*, Growth Products, White Plains, NY.
 2. Application Rate: Provide at prescribed rate and application per Manufacturer's written recommendations.
- C. Wetting Agent and Soil Penetrant (Surfactant): Highly-concentrated liquid solution. Provide in a diluted liquid solution, mixed with water, at the time of watering-in recently planted plant species.
1. Products & Manufacturer's: Subject to compliance with requirements, provide products by one (1) of the following:
 - a. *Roots NoBurn®*, Novozymes Biologicals, Inc., Salem, VA.
 - b. *LESCO-Wet™ Plus*, Lescos, Inc., Cleveland, OH.
 - c. *Naiad Liquid Wetting Agent*, Naiad Company, Inc., Stockton, CA.
 - d. *Aqua-Gro L*, Scotts Company, Marysville, OH.
 - e. *Sixteen-90*, Aquatrols, Cherry Hills, NJ.
 - f. Or equal, as approved by the Landscape Architect.
 2. Application Rate: Provide at prescribed rate and application per Manufacturer's written recommendations, per one-hundred (100) gallons of water.
- D. Plant Vitamin/Hormone Stimulant: Highly-concentrated liquid vitamin solution. Provide in a diluted liquid solution, mixed with water, at the time of watering-in recently planted plant species.
1. Products & Manufacturer's: Subject to compliance with requirements, provide products by one (1) of the following:
 - a. *SUPERthrive*, Vitamin Institute.
 - b. *Roots Concentrate Rooting Stimulant*, Novozymes Biologicals, Inc.
 - c. *Root-Maxx Plus*, Bio-Plex.
 - d. Or equal, as approved by the Landscape Architect.

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2. Application Rate: Provide at prescribed rate and application per Manufacturer’s written recommendations, per one-hundred (100) gallons of water.
- E. Herbicides: EPA registered and approved, from the following:
1. Non-Selective Post-Emergent Herbicide: Spray-applied solution containing a minimum of 41% of the active ingredient “glyphosate” (full strength), with a surfactant, mixed with water accordingly per the Manufacturer’s directions.
 - a. Products & Manufacturer’s: Subject to compliance with requirements, provide products by one (1) of the following:
 - 1) *Roundup® PRO*, (41% glyphosate), Monsanto Company.
 - 2) *Roundup® PROmax* (concentrate, 50% glyphosate), Monsanto Company.
 - 3) *Honcho® Plus*, (41% glyphosate), Monsanto Company.
 - 4) *Prosecutor* (41% glyphosate), LESCO, Inc.
 - 5) *High Yield® Kill-Zall Weed & Grass Killer*, (41% glyphosate), Voluntary Purchasing Groups.
 - 6) Or equal, as approved by the Landscape Architect.
 - b. Application Rate: Provide at prescribed rate and application per Manufacturer’s written recommendations, per one-hundred (100) gallons of water.
 2. Selective Pre-Emergent Herbicide (Packaged dry material application): Pre-emergent control of annual grasses and broadleaf weeds in turf grass areas, and woody ornamental trees, shrubs, vines, and groundcover areas.
 - a. Products & Manufacturer’s: Subject to compliance with requirements, provide products by one (1) of the following:
 - 1) *Ronstar® 2G*, (granular), Aventis Environmental Science USA.
 - 2) *Snapshot® 2.5 GT* (granular), (2% trifluralin), Dow AgroSciences LLC.
 - 3) *XL*2G*, SETRE Chemical Company.
 - 4) *Casoron 4G*, Chemtura.
 - 5) *Treflan® HFP* (43% trifluralin), Dow AgroSciences LLC.
 - 6) *Treflan® TR-10*, (10% Granular trifluralin), Dow AgroSciences LLC.
 - 7) *Surflan®*, Dow AgroSciences, LLC.
 - 8) Or equal, as approved by the Landscape Architect.
 - b. Application Rate: Provide at prescribed rate and application per Manufacturer’s written recommendations, per one-hundred (100) gallons of water.
 3. Selective Post-Emergent Herbicide: Pre-mixed, flow-able formulation designed for product stability, uniformity in the spray solution and ease of handling. Post-emergent control of annual grasses, nutsedge, and broadleaf weeds in turf, generally with one (1) application.
 - a. Products & Manufacturer’s: Subject to compliance with requirements, provide products by one (1) of the following:
 - 1) *Trimec® Plus*, PBI/Gordon Corporation.
 - 2) *Three-Way*, LESCO, Inc.
 - 3) Or equal, as approved by the Landscape Architect.
 - b. Application Rate: Provide at prescribed rate and application per Manufacturer’s written recommendations, per one-hundred (100) gallons of water.

PART 3 - EXECUTION

3.1 GENERAL

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- A. Installation practices of the Landscape Planting Accessories shall be performed during those periods when weather and soil conditions are suitable and in accordance with locally accepted horticultural practice, as approved by the Landscape Architect. Contractor shall notify the Landscape Architect, in writing, on the anticipated commencement date and length of duration of the landscape installation.
- B. Examination: Examine areas to receive landscaping for compliance with requirements and for conditions affecting performance of Work of this Section. No work under this section shall commence until all submittals under this section have been reviewed and approved, in writing. Do not proceed with installation until unsatisfactory conditions have been corrected.
- C. Prior to Work in this Section, Contractor shall examine previously installed Work from other trades and verify that such Work is complete and as required, to the point where the installation of the Landscape Planting Accessories may commence properly.

3.2 PROTECTION OF SITE

- A. Contractor shall protect existing and new improvements and systems installed prior to installation of Landscape Planting Accessories. Maintain protection in place until completion of Work and Landscape Establishment Period.

3.3 MULCHING

- A. General: Mulch backfilled surfaces of pits, trenches, planted areas, and other areas indicated.
- B. Shredded Wood Mulch:
 - 1. General: Verify locations to receive Shredded Wood Mulch.
 - 2. Apply the following average thickness of Shredded Wood Mulch, and finish level with adjacent finished surfaces. Do not place Shredded Wood Mulch directly against trunks or stems of Plant Materials. Remove Shredded Wood Mulch that is placed against the growing bases or within the basal nodes of plants.
 - 3. Thickness/Depth: Three-inches (3”), minimum.
 - 4. While settlement and/or decomposition of the Shredded Wood may occur during the duration of the Contract, the Shredded Wood Mulch thickness as indicated shall be consistent throughout the duration of the Contract. The Contractor shall provide additional Shredded Wood Mulch, as needed, and as directed by the Landscape Architect, to maintain the specified constant thickness of the Shredded Wood Mulch, until Acceptance of Work is granted.

3.4 INSTALLATION OF MISCELLANEOUS MATERIALS

- A. Anti-Dessicant: Apply using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage.
 - 1. When deciduous trees or shrubs are moved in full-leaf, spray with anti-desiccant at nursery before moving and again two (2) weeks after planting.
- B. Stress Reducing Agent: Apply, as required and directed by the Landscape Architect, per Manufacturer’s latest printed instructions.

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- C. Wetting Agent & Soil Penetrant: Apply, as required and directed by the Landscape Architect, per Manufacturer's latest printed instructions.
- D. Herbicides: Apply, as required and directed by the Landscape Architect, per Manufacturer's latest printed instructions.
- E. Plant Vitamin/Root Stimulant: Apply, per the Manufacturer's latest printed instructions. Refer to application requirements per Section 329300 – Exterior Plants.

3.5 CLEAN UP AND PROTECTION

- A. For Work under this Section, keep Work area in a clean, orderly, and safe condition. Contractor shall remove trash caused from his Work on a weekly basis throughout the duration of the Work.
- B. Protect landscaping from damage due to landscape operations, operations by other Contractors and trades, and trespassers. Maintain protection during installation and landscape establishment periods. Treat, repair, or replace damaged Landscape Planting Accessories as directed.
- C. Upon completion of his Work under this Section, the Contractor shall remove rubbish, waste, debris, excess construction materials, and other items resulting from construction operations offsite as described herein this Section and directed by the Landscape Architect.

3.6 FINAL REVIEW

- A. Final Review under this Section shall be performed upon completion of the Landscape Establishment Period. (Refer to Section 329813 – Landscape Establishment Period for requirements).

END OF SECTION

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SECTION 329813 – LANDSCAPE ESTABLISHMENT PERIOD

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work, as required to make a complete Landscape Establishment Period (“Service”), as specified during progress of the Work, after installation, for a designated period after Preliminary Acceptance, as shown in the Contract Drawings, and as specified herein this Section.
- B. Contractor acknowledges that the Services specified under this Section are not intended to express every detail of the Services to be provided by Contractor, and Contractor hereby represents that it is experienced and competent in providing Services that meets or exceeds generally accepted practices commensurate with those provided by other companies that provide such Service.
- C. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:
 - 1. Establishment of Landscape Installation, for a given frequency and duration as specified herein this Section. Work includes the following:
 - a. Litter Control.
 - b. Weed Control.
 - c. Pest Control.
 - d. Plant Care.
 - e. Fertilization of Plant Materials.
 - f. Plant Replacement.
 - g. Plant Pruning.
 - h. Plant Staking and Adjustments.
 - i. Temporary Plant Protection.
 - j. Operation, Adjustment, and Maintenance of Irrigation Controller and Irrigation System.
 - k. Cleaning of Paving Surfaces.
 - l. Reapplication of Mulching Materials.
 - m. Erosion Control and Drainage.
 - n. Removal of Green Waste.
- D. Related Sections: The following Sections contain requirements that relate to Work in this Section:
 - 1. Section 312219 – Landscape Grading.
 - 2. Section 321513 – Stabilized Decomposed Granite (Site Paving & Landscape Mulch).
 - 3. Section 328400 – Irrigation Systems.
 - 4. Section 329113 – Soil Preparation.
 - 5. Section 329200 – Lawns & Grasses.
 - 6. Section 329300 – Exterior Plants.
 - 7. Section 329400 – Landscape Planting Accessories.

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1.2 DEFINITIONS AND APPLICABLE STANDARDS

A. References:

1. USDA – United States Department of Agriculture.
2. ASTM – American Society for Testing & Materials.
3. ANSI – American National Standards Institute.
4. ISA – International Society of Arboriculture.

B. Standards:

1. American National Standard for Tree Care Operation, Tree, Shrub, and Other Woody Plant Maintenance (ANSI A300), American National Standards Institute, Latest Edition.
2. American National Standard for Tree Care Operations (ANSI Z133), American National Standards Institute, Latest Edition.
3. Tree Pruning Guidelines, International Society of Arboriculture, 1995 Edition.
4. Pruning Standards for Shade Trees, National Arborists Association, Latest Edition.

1.3 SUBMITTALS

A. General:

1. Collect information into a single Submittal for each element of construction and type of product or equipment identified under this Section for review.
2. To expedite review, Submittal shall be organized and presented into specific sections or headings. Furnish neat, concise, legible, and clearly identifiable information, and sufficiently explicit detail, to enable proper evaluation for Contract compliance. Highlight catalog, product data, or brochures containing various products, sizes, and materials to show particular item submitted.
3. Submittal Format: As applicable, furnish Submittal as a single electronic digital PDF (Portable Document Format) file.

B. Digital Submittal Information:

1. Quality Control Submittal:
 - a. Qualification Data: Submit names for firms and persons specified in the “Quality Assurance and Control” Article to demonstrate their capabilities and experience on similar Landscape Planting Accessories installations.
 - b. Schedule of maintenance operations and monthly status report, including list of equipment, materials proposed for the job, and watering schedule(s).
 - c. Licenses, permits and insurance required by the local jurisdiction, the State, or Federal government, pertaining to Work under this Section.
 - 1) Pesticide Applicator: Valid California Qualified Applicator Certificate (QAC), with “B – Landscape Maintenance” Category, as administered by the California Department of Pesticide Regulation (DPR).
 - d. Monthly record of herbicides, insecticides and disease control chemicals used for the Project.
 - e. Written application recommendation by a licensed agricultural pest control advisor for weed, pest and disease controls restricted by the Director of Agriculture proposed for this Work.
2. Project Closeout Submittal:
 - a. Include in a single 3-ring binder a Landscape Maintenance Manual for use by the Owner, containing an indexed collection of all schedules, records and permits

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listed above, including documentation of accepted condition of planting and irrigation at Final Acceptance.

- C. Material Samples: Not required.
- D. Scaled Shop Drawings: Not required.
- E. Field-Constructed Mock-ups: Not required.
- F. Submittals under this Article will be rejected and returned without the benefit of review by the Landscape Architect if they are difficult to read due to insufficient scale, poor image quality, or poor drafting quality; or if all of the required information is missing or not presented in the format as requested. Partial Submittals will not be accepted.
- G. No Work shall proceed under this Section until Submittal requirements indicated herein have been reviewed accordingly by the Landscape Architect.

1.4 QUALITY ASSURANCE AND CONTROL

- A. Qualifications:
 - 1. Valid California C-27 (Landscaping Contractor) License.
 - 2. Experience: Contractor or sub-contractor performing Work under this Section shall have a full-time employee assigned to the Project as foreman for the duration of the Contract. Employee shall have a minimum of four (4) years experience in landscape maintenance supervision, with experience or training in entomology, pest control, soils, fertilizers and plant identification. Employee shall speak English fluently.
 - 3. Labor Force: Landscape maintenance labor force shall be thoroughly familiar with, and trained in, the Work to be accomplished, and shall perform the task in a competent, efficient manner acceptable to the Owner.
- B. Requirements:
 - 1. Supervision: Landscape Maintenance Foreman shall directly supervise the Work force during duration indicated herein this Section. Notify Owner of changes in supervision.
 - 2. Identification: Provide proper identification during duration for landscape maintenance firm's vehicles and labor force. Be uniformly dressed in a manner satisfactory to the Owner.

1.5 PROJECT/SITE CONDITIONS

- A. Site Visit: At beginning of the designated Landscape Establishment Period, visit and tour the site with the Owner's Representative, Landscape Architect, and other interested parties, to clarify the scope of Work, and understand existing project/site conditions.
- B. Documentation of Conditions: Document the general condition of installed plant materials, recording those which are healthy and thriving, and unacceptable materials which are damaged, dead, and/or dying and in need of replacement.
- C. Irrigation System: Document general condition of existing irrigation system, making sure that faulty, improper, and/or non-functioning irrigation materials or equipment are reported.

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1.6 SEQUENCING AND SCHEDULING

- A. Perform Work under Landscape Establishment Period during hours mutually agreed upon between Owner and Contractor.
- B. Work force shall be present at the Project Site at a minimum duration indicated in this Section, and at other times as necessary, to perform specified Work, in accordance with the approved schedule under the Landscape Establishment Period.

1.7 WARRANTY

- A. Specific Requirements: Refer to the following Sections:
 - 1. Section 328400 – Irrigation Systems.
 - 2. Section 329200 – Lawns & Grasses.
 - 3. Section 329300 – Exterior Plants.
 - 4. Section 329400 – Landscape Planting Accessories.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Materials and equipment as required to perform Work under this Section shall be provided by Contractor.
- B. Water: Clean, potable and fresh, as available from Owner.
- C. Fertilizers:
 - 1. Fertilizer Tablets: Tightly compressed, slow-release and long-lasting complete fertilizer tablets, bearing manufacturer's label of guaranteed analysis of chemicals present. Refer to Section 329113 – Soil Preparation, for requirements.
 - 2. Balanced, once-a-season application, controlled-release Fertilizer(s), with a blend of coated prills which supply controlled-release nitrogen, phosphorus and potassium, and uncoated, rapidly soluble prills containing nitrogen and phosphorus.
- D. Herbicides, Insecticides, and Fungicides:
 - 1. Provide materials with original manufacturers' containers, properly labeled with guaranteed analysis.
 - 2. Use non-staining materials.
- E. Replacement Tree Guys, Stakes, Ties and Wires: Match originally accepted existing materials installed on the Project.

2.2 EQUIPMENT

- A. General: Use only the proper tool(s) required for each task under this Section.
 - 1. Maintain tools in sharp, properly-functioning condition.
 - 2. Clean and sterilize all pruning tools prior to usage.

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- B. Insect/Disease Prevention: Provide measures to prevent introduction of insect or disease-laden materials onto the Site. Refer to Section 329300 – Exterior Plants.

PART 3 - EXECUTION

3.1 FREQUENCY AND DURATION OF LANDSCAPE ESTABLISHMENT PERIOD

- A. Following satisfactory completion of all items included on the Landscape Punch List, the contracted Landscape Establishment Period shall commence and progress.
- B. Frequency and Duration:
 - 1. Work performed under this Section shall be executed by Contractor at a minimum of once per week, for a duration of a minimum of 90 calendar days.

3.2 COMMENCING THE LANDSCAPE ESTABLISHMENT PERIOD

- A. Preliminary Review: As soon as landscape installation is substantially completed per the Contract Documents, Contractor shall arrange to hold a preliminary review on-site with the Landscape Architect, Owner, and other interested parties to evaluate the condition and execution of the completed Work. Evaluation of the Work shall be executed by the Landscape Architect through a “Landscape Punch List”.
- B. Date of Review: Notify Landscape Architect at least five (5) working days prior to anticipated Date of Review.
- C. Commencing the Landscape Establishment Period: The date on which the Landscape Architect determines that the landscape installation is substantially-complete, whereas outstanding Work included on the Landscape Punch List is addressed and satisfactorily completed to the satisfaction of the Landscape Architect.

3.3 PREPARATION

- A. Protection:
 - 1. Protect new landscape planting areas from damage during duration of Landscape Establishment Period, until Final Acceptance.
 - 2. Provide temporary protection fences, barriers and signs, as required, for protection.
- B. Replacements:
 - 1. Immediately treat or replace plant materials as directed, which become damaged or injured as a result of Contractor's operations or negligence, per the Landscape Architect, at no additional cost to Owner.
 - 2. Replacement plant materials shall match size and variety of plant material being replaced.

3.4 PLANTING ESTABLISHMENT

- A. Watering Basins:

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1. Maintain watering basins around the perimeter of the installed plant materials so that enough water can be applied to establish and maintain adequate soil moisture through the root zone of the plant materials. Re-dish and tamp basins accordingly which have become damaged or have failed since installation.
 2. For supplemental hand watering of watering basins, use a water wand to break the water force. Do not permit use of "jet" type watering equipment. Do not permit crown roots to become exposed to air through dislodging of soil and mulch.
 3. Mulch: Maintain originally specified thickness of mulch material to reduce evaporation and frequency of watering.
 4. During rainy season, open basins to allow surface drainage away from the root crown where excess water may accumulate. Restore watering basins at end of rainy season.
 5. At the end of the rainy season, re-dish and tamp watering basin at trees and shrubs.
- B. Settlement of Plant Materials: Reset/replant sunken or settled plant materials to proper grades and in upright position.
- C. Weed Control:
1. Planting areas throughout site shall be weed-free at all times, including areas between plants and along watering basins.
 2. Use only recommended and legally-approved herbicides to control and maintain weed growth.
 3. Avoid frequent soil cultivation that destroys shallow roots and breaks the seal of pre-emergent herbicides.
- D. Pruning:
1. Prune trees to select and develop permanent scaffold branches that are smaller in diameter than the trunk or branch to which they are attached, and which have vertical spacing of eighteen-inches (18") to forty-eight-inches (48") and radial orientation so as not to overlay each another.
 2. Prune trees to eliminate diseased or damaged growth, and narrow "V-shaped" branch forks that lack strength. Reduce toppling and wind damage by thinning-out crowns.
 3. Prune trees to maintain growth within space limitations, maintaining a natural appearance and balancing crown with roots.
 4. No stripping of lower branches of young trees shall be permitted.
 5. Retain lower branches in a "tipped back" or pinched condition to promote caliper trunk growth. Do not cut back to fewer than six (6) buds or leaves on such branches. Only cut lower branches flush with the trunk after the tree is able to stand erect without staking or other support.
 6. Thin out and shape evergreen trees when necessary to prevent wind and storm damage. Do primary pruning of deciduous trees during the dormant season. Do not permit any pruning of trees prone to excessive "bleeding" during growth season.
 7. Prune damaged trees or those that constitute health or safety hazards at any time of year as required.
 8. Make pruning cuts clean and close to the trunk, without cutting into the branch collar. "Stubbing" will not be permitted. Cut smaller branches flush with trunk or lateral branch. Make larger cuts one-inch (1") diameter or larger parallel to shoulder rings, with the top edge of the cut at the trunk or lateral branch.
 9. Branches too heavy to handle shall be precut in three (3) stages to prevent splitting or peeling of bark. Make the first two (2) cuts eighteen inches (18") or more from the trunk to remove the branch. Make the third cut at the trunk to remove the resulting stub.

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10. Do not prune or clip shrubs into balled or boxed forms unless specifically called for by design.
 11. Clip shrubs to be hedged when branches project two-inches (2") beyond limit of clipped hedge shown on the Contract Drawings.
 12. Take extreme care to avoid transmitting disease from one infected plant to another. Properly sterilize pruning tools before going from one infected plant to other plant materials.
- E. Maintenance of Existing Plant Materials to Remain:
1. General: Conform to applicable paragraphs regarding pruning, watering, spraying and fertilizing of new plant materials as indicated herein this Section.
 2. Symptoms: Be alert to symptoms of construction damage to existing plantings as evidenced by wilting, un-seasonal or early flowering or loss of leaves, and insect or disease infestation due to declining vigor.
 3. Notification: Submit in writing of evidences of declining vigor immediately upon discerning the problem. Take appropriate interim measures to mitigate the severity of the problem as specified in this Section.
 4. Proposal: Submit written proposal and cost estimate for the correction of all conditions before proceeding with permanent correction Work.

3.5 GROUNDCOVER ESTABLISHMENT

- A. Irrigation:
1. Check for moisture penetration throughout the root zone at least twice a month.
 2. Water as frequently as necessary to maintain healthy growth of groundcovers.
- B. Weed Control:
1. Control weeds, preferably by hand removal, with pre-emergent herbicides and with selective systemic herbicides.
 2. Minimize hoeing of weeds in order to avoid plant damage.
- C. Fertilization:
1. Recently installed plant materials: Verify with Owner actual completion date of planting installation and rate of prior application of fertilizers.
 2. New Plant Materials: Place Planting Tablets (per Section 329113 – Soil Preparation) beside the root ball about one-inch (1") from root tips.
 3. Established Plant Materials: Do not use complete fertilizers unless soil test shows specific nutrient deficiencies.
- D. Mowing and Edging:
1. Edge groundcovers to keep in bounds. Trim top growth as necessary to achieve an overall even appearance.
 2. Ground covers which lend themselves to mowing shall be mowed to specified height above finished grade in order to renew growth, improve density and attractiveness.
- E. Replacements:
1. Replace dead and missing plants after obtaining Owner's agreement to pay for replacement.
 2. Damages due to Contractor's negligence shall be paid for without charge to Owner.

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3.6 TURF GRASS ESTABLISHMENT

A. Irrigation:

1. Irrigate Turf Grass at such frequency as weather conditions require, to replenish soil moisture to six inches (6”) below root zone.
2. Provide a total of one-one-half inches (1-1/2”) of water weekly, during hot summer weather, in three (3) applications per week, minimum.
3. Water at night if irrigation system is electrically controlled. Otherwise, watering shall be done during early mornings.

B. Weed Control:

1. Control broadleaf weeds with selective herbicides.
2. In areas where crabgrass has infested the turf grass, apply a selective post-emergent herbicide as soon as possible, and prior to flowering.
3. Apply pre-emergent herbicides prior to crabgrass germination.
4. Do not irrigate for forty-eight (48) hours after application of herbicidal sprays.
5. Coordinate application of herbicides with thatch control and reseeding schedule as described below.

C. Mowing and Edging:

1. Mowing:

- a. Mow Turf Grass at a frequency so the maximum grass heights are maintained as listed below:

Turf Type	Growing Season	Dormant Season
Bluegrass or Tall Fescue	2 to 4”	2 to 3”
Perennial Ryegrass	2.5 to 3.5”	2 to 3”
Hybrid Bermuda	1.5 to 2”	2 to 3”
St. Augustine	2.5 to 4”	2 to 3”

- b. Mulching mowers shall not be used.
 - c. Turf grass shall be cut with rotary mowers to maintain a uniform and horticulturally correct height.
 - d. Blades shall be kept sufficiently sharp and properly adjusted to provide a cleanly-cut grass blade. Grass blade bruising, tearing, or shredding shall be prevented.
 - e. Mowing pattern/direction shall be rotated weekly where feasible to prevent rutting and minimize compaction.
- ##### 2. Edging:
- a. Sidewalks, curbs, plants, walkways, roadway edges, space between planter beds, curbs, headers, and bed edges shall be mechanically edged with a steel blade edger on each visit, not to exceed seven (7) days, to maintain a neat, clean turf edge. String-type edgers shall not be used for this function.
 - b. Clippings shall either be vacuumed or blown-off all surfaces, or may be blown back to lawn, but no visible clumps of cut grass shall remain. Clippings, if bagged, shall be removed from the property on the same day the property is serviced.
- ##### 3. String Trimming:
- a. String Trimming shall be performed on a weekly basis around roadway signs, guard posts, trees, shrubs, utility poles, and other obstacles where mowers cannot reach. Do not allow string trimming to damage the trunk or foliage of plants.

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- b. Grass shall be trimmed to the same desired height as determined by the mowing operation.
 - c. Particular shall be given to trimming around sprinkler heads and other irrigation appliances to provide maximum water coverage.
 - d. Turf adjacent to tree wells, valve boxes, and quick coupling valves shall be trimmed as needed to maintain a clean appearance. Chemical defoliant or herbicides shall not be used as an “edger” in these areas.
 - 4. Chemical Edging:
 - a. Chemical application may be used to kill weeds and turf in and around areas adjacent to buildings, the base of fence lines, or where bed edges do not exist.
 - b. Chemicals shall be used accordingly to applicable rules and regulations.
- D. Reseeding/Overseeding:
 - 1. Reseeding/Overseeding: Match existing seed mix of adjacent areas. Refer to Section 329200 – Lawns & Grasses.
- E. Renovating of Existing Lawns (where applicable):
 - 1. Thatch Control: Maintain thatch layer at 1/2 in. depth or less. Verticut as required.
 - a. Three (3) weeks before verticutting turf grass, apply nitrate fertilizers.
 - b. Perform verticutting operations preferably in the fall months, but otherwise during the spring months. Remove all debris from verticutting. Overseed as needed.
 - c. Over-seeding must not be followed by application of pre-emergent herbicides for at least four (4) to six (6) weeks. Normally this means that turf grasses invaded by weeds shall be renovated and over-seeded in the Fall, and treated for weed control in the following late Winter.
- F. Core Aeration:
 - 1. Do not perform aeration work during season of active weed germination.
 - 2. Aerify compacted areas to improve water penetration when needed, using a piston-driven aerifier with hollow tines. Rake up and remove all resulting soil cores. Fertilize and irrigate immediately after clean-up of cores.
 - 3. Contractor shall be responsible for locating and flagging irrigation devices, equipment, and lines prior to aerating.
- G. Fertilization:
 - 1. Recently seeded/sodded Turf Grass areas: Verify with Owner previous applications of fertilizer(s).
 - 2. Established Turf Grass areas: Apply a slow-release (3 to 5 months) fertilizer (21-8-8; N-P-K) once in spring and again in the fall at the following rates:

<u>Program</u>	<u>1000 sq. ft.</u>	<u>Acre</u>
Optimum	15 lbs.	650 lbs.
Medium	12 lbs.	500 lbs.
Low	8 lbs.	350 lbs.

- 3. Apply fertilizer when turf grass is dry and preferably after mowing. Do not apply during hot weather or when turf grass is under stress. Water immediately after application.
 - 4. Apply only nitrogen unless a soil test shows a specific nutrient deficiency.
 - 5. If soil pH gets below 6.0, then a basic fertilizer such as calcium nitrate may be preferable to an acidic fertilizer. Follow the soil chemist's recommendation when deficiencies appear.

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3.7 INSECTS, PESTS, AND DISEASE CONTROL

- A. Inspection: Inspect plant materials for signs of stress, damage and potential trouble from the following:
 - 1. Presence of insects, moles, gophers, rabbits, ground squirrels, snails and slugs in planting areas.
 - 2. Discolored or blotching leaves or needles.
 - 3. Unusually light green or yellowish green color inconsistent with normal green color of leaves.
- B. Personnel: Only licensed, qualified, trained personnel shall perform spraying for insect, pest and disease control.
- C. Application: Spray with extreme care to avoid all hazards to any person or pet in the area or adjacent areas.
- D. Lawn or vegetation-damaging pests shall be controlled in a timely manner to minimize damage.

3.8 IRRIGATION

- A. General:
 - 1. Apply water in sufficient quantities and as often as seasonal conditions require to keep installed planted areas moist at all times, well below the root system of plants. Hand water as required if irrigation system is not fully functional.
 - 2. Repair without additional charge to Owner damages to Irrigation System caused by Contractor's operations. Perform repairs within one (1) watering period.
 - 3. Report promptly to Owner accidental damage not resulting from Contractor's negligence or operations.
 - 4. Twice a month, use a probe or other acceptable tool to check the rootball moisture of representative plants as well as the surrounding soil.
- B. Cleaning and Monitoring the System:
 - 1. Continually monitor the irrigation systems to verify that they are functioning properly as designed. Make program adjustments required by changing field conditions.
 - 2. Prevent spraying on windows, building walls, by balancing the throttle control on the remote control valves and the adjustment screws on the sprinkler heads. Do not allow water to atomize and drift.

3.9 AGGREGATE SURFACING MATERIALS

- A. Aggregate Surfacing:
 - 1. Maintain Aggregate Surfacing materials at the depth indicated in the Contract Documents. Replace Aggregate Surfacing that is unlike in character (color, size, texture). Defective, fractured, stained, or material which does not meet the requirements herein in this Section shall be removed and replaced with appropriate Aggregate Surfacing material as specified.
 - 2. Rake Aggregate Surfacing surfaces smooth, consistent, and level, with no depressions, voids, rills, footprints, etc. Fines from the Aggregate Surfacing that are located on the

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finished surface shall be raked and/or removed accordingly to maintain a clean, consistent Aggregate Surfacing finish.

3. Maintain Aggregate Surfacing free of stains, weeds, discoloration, trash, fines, debris, soil, sand, or other foreign material.
 - a. Contractor shall exercise care so as not to contaminate Aggregate Surfacing with Shredded Wood Mulches, plant materials, soil, or other foreign substances.
 - b. Soil that has contaminated the Aggregate Surfacing areas shall be removed from the Aggregate Surfacing. Raking to “hide” the soil below the finished surface of the Aggregate Surfacing is not acceptable.

3.10 GRADING AND DRAINAGE

- A. During the Landscape Establishment Period, all flow lines shall be maintained to allow for free flow of surface water. Displaced material which interferes with drainage shall be removed and placed as directed. Low Spots and pockets shall be graded to drain properly. Jute netting or other erosion control measures as directed shall be installed at flow lines and other locations where surface erosion is evident.
- B. Damage to planting areas shall be repaired immediately and throughout the Landscape Establishment Period. Depressions caused by vehicles, bicycles, or foot traffic shall be filled and leveled. Replant damaged areas.
- C. All paved areas shall be washed and maintained in a neat and clean condition at all times.
- D. All subsurface drains and inlets shall be periodically cleared of debris, leaves, trash, etc., and flushed with clear water to avoid buildup of silt and debris.

3.11 CLEANING

- A. General: Dispose of pruned plant materials, vacuum turf grass clippings and leaves, sweep walkways and rake smooth mulched areas. Remove from the site containers and other evidence of maintenance activities.
- B. Litter Control:
 1. Site areas under the Contract shall be cleared on a weekly basis of visible litter or debris, grass clippings, and garage.
 2. Debris caused by normal seasonal winds shall be removed from site
 3. Contractor shall be responsible for disposal of debris in accordance with local rules and regulations.
- C. Blowing:
 1. Landscape debris generated by Work under this Section shall be blown-off or swept on a weekly basis. Do not blow grass clippings, edgings, or debris into shrub beds or onto paved areas unless after such blowing, the resultant accumulation of material is gathered and removed from the site.

3.12 TERMINATION OF THE LANDSCAPE ESTABLISHMENT PERIOD

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- A. Final Acceptance Procedure:
 - 1. Work will be accepted by the Landscape Architect upon satisfactory completion of all Work, including Landscape Establishment Period, but exclusive of replacement of materials under the Warranty Period.
 - 2. Submit a written request to Landscape Architect for review for Final Acceptance at least five (5) working days prior to anticipated Final Review date, which is at the end of the Landscape Establishment Period.

- B. Corrective Work:
 - 1. Work requiring corrective action or replacement shall be performed within ten (10) calendar days after the Final Review.
 - 2. Perform corrective Work and materials replacement in accordance with the Contract Documents, Work shall be made by the Contractor at no cost to the Owner.
 - 3. After corrective Work is completed, the Contractor shall again request a Final Review for Final Acceptance as outlined above.
 - a. Continue maintenance of all landscaped areas until such time as all corrective measures have been completed and accepted.

- C. Conditions for Acceptance of Work at End of Landscape Establishment Period:
 - 1. Each plant shall be alive and thriving, showing signs of growth and no signs of stress, disease, or any other weaknesses.
 - 2. Replace plant materials not meeting these conditions. An additional Warranty Period equal in length to the original shall be commenced for all such plants and planted areas.

- D. Final Acceptance Date: The date on which the Landscape Architect issues a Letter of Final Acceptance. Upon Final Acceptance, Owner will assume responsibility for maintenance of the Work beyond the Landscape Establishment Period.

3.13 CLOSE OUT

- A. Landscape Maintenance Record:
 - 1. Submit binder to Owner with documentation and records required and utilized during the Landscape Establishment Period.

- B. Keys and Identification: Return keys and identification materials supplied by Owner for the purpose of site access.

END OF SECTION

EXHIBIT "A" – SCHEDULE OF PERFORMANCE

CITY OF HERMOSA BEACH

CIP No. 689- CLARK BUILDING RENOVATIONS

SECTION 1. BEGINNING OF WORK, TIME OF COMPLETION

1. Attention is directed to the provisions of Section 6-1 ("Construction Schedule and Commencement of the Work"), Section 6-1.1 ("Construction Schedule"), and Section 6-9 ("Liquidated Damages"), of the State Specifications, and these Provisions.
2. The Contractor shall complete work within 120 working days after receiving the "Notice to Proceed".
3. The Contractor and its securities will pay the sum of one thousand two hundred dollars (\$1,200) as liquidated damages for each working day of delay in the performance of the work in this agreement and as shown on the plans.

EXHIBIT “B” – SOLID WASTE REPORTING

CITY OF HERMOSA BEACH

CIP No. 689- CLARK BUILDING RENOVATIONS

SOLID WASTE REPORTING

Pursuant to the California Integrated Solid Waste Management Act of 1989, the City is required to report the amount of solid waste generated within the City and the disposal of that waste with the ultimate required goal of being a reduction of at least 50% in the amount of solid waste being disposed in landfills. To permit the City to comply with this State law, the contractor is required to complete the Solid Waste Report form, a copy of which is included in these special provisions. The report includes a summary of the solid waste generated by the project, a summary of solid waste disposed of at class III landfills and a summary of solid waste diverted from disposal through recycling and re-use. The contractor may use a self-generated report format that includes all of the information included on the City form.

The report shall be filed with the City after project completion and prior to final payment. If the project time span includes more than one calendar year, a separate report is required for the solid waste in each calendar year. A report for a calendar year that does not coincide with project completion shall be filed with the City on or before January 31st.

Supporting documents to be submitted with the report shall include legible copies of weigh tickets, receipts, or invoices that specifically identify the job site location that generated the waste materials. If materials are taken to a location where weigh tickets, receipts, or invoices are not available, the contractor shall provide the documentation on its own company letterhead.

The contractor is encouraged to divert solid waste from disposal at landfills through recycling and re-use when possible while maintaining compliance with all other contract specifications and special provisions.

**Contractor's Construction and Demolition
Waste Diversion Reporting Form**

Job Site Address (where waste was generated):

City Permit No.:

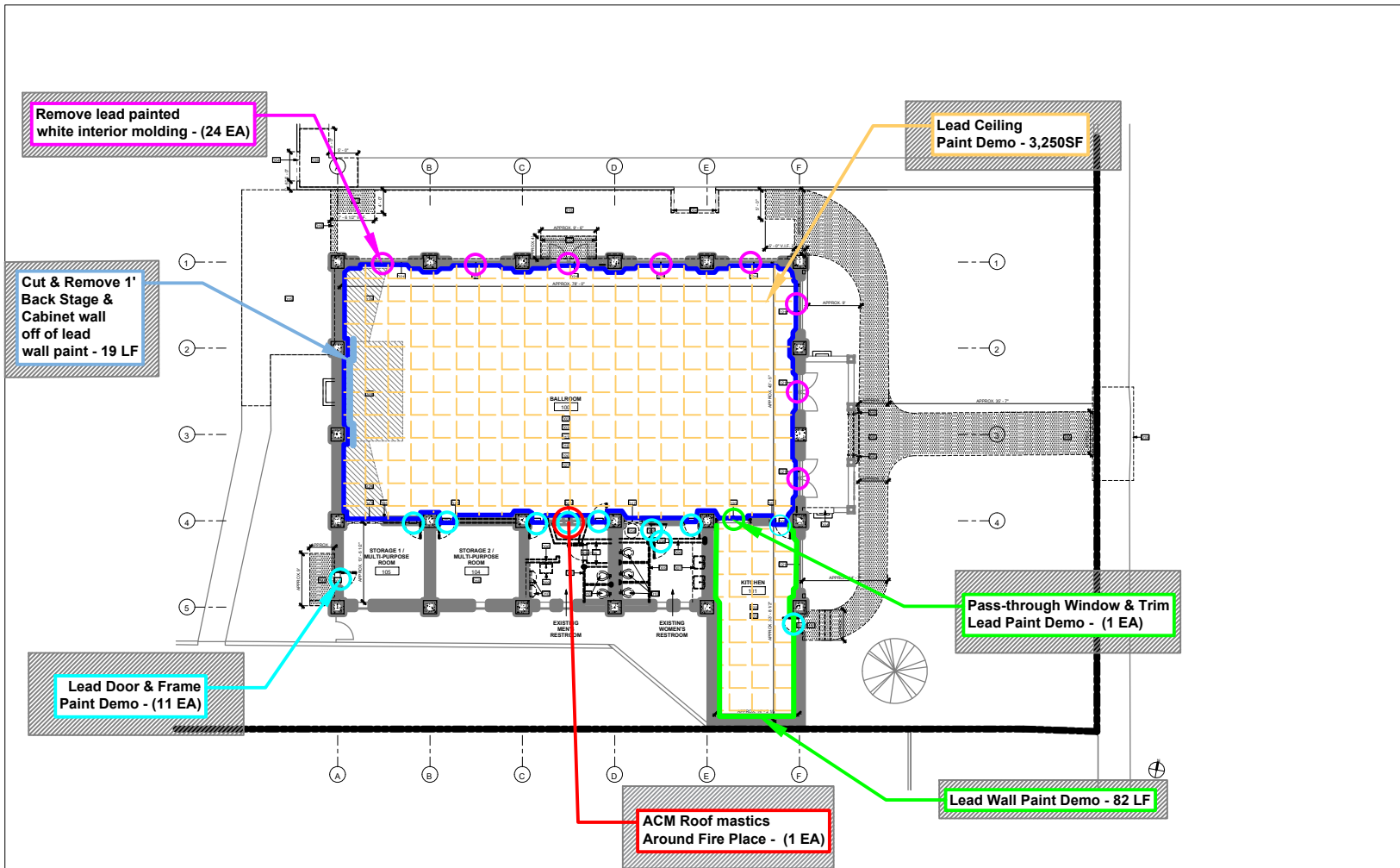
Material	Name of Facility/Site Where Taken	Disposal	Aggregate	Recycled or Reused				
				Alter-native landfill	Compost	Engineer ed Fill	Mulch	Other
				Tons	Tons	Tons	Tons	Tons
ASPHALT								
CONCRETE								
DIRT								
GREEN WASTE								
METAL								
OTHER SEGREGATED MATERIALS(Describe)								
ROCKS								
WOOD								
MIXED WASTE								
OTHER CONSTRUCTION OR DEMOLITION WASTE								
TOTAL								

COMPANY NAME:

DATE OF REPORT:

EXHIBIT “C”

PHASE 1 REPORT (LEAD AND ASBESTOS CONTAINED MATERIAL)



- All interior grey, green, yellow, and beige paint on plaster substrate in this structure are **lead-based**.
- All Original interior door paint, trim paint, and plaster paint in the kitchen, restrooms, auditorium of this building are **lead-based**.
- All interior white paint on plaster substrate is **lead-containing**.
- Baseboard paint in the auditorium/ballroom is **lead-based**.
- Roofing mastics on this structure contain **asbestos**.

Figure 1: Lead & Asbestos Material Locations
 Clark Building
 861 Valley Drive
 Hermosa Beach, CA 90254

Firm Name and Address
 Ellis Environmental Mgmt, Inc.
 430 Silver Spur Rd., Suite 201
 Rancho Palos Verdes, CA 90275

Client Name and Address
 City of Hermosa Beach
 Public Works Department

Exhibit "C" - Lead and Asbestos Report Provided By Ellis
Environmental On Oct. 11, 2022

October 11, 2022

Jonathan Pascual
Assistant Engineer
City of Hermosa Beach
1315 Valley Dr.,
Hermosa Beach, CA 90254**RE: Supplemental Bulk Sampling for Asbestos
City of Hermosa Beach – Clark Building
861 Valley Drive, Hermosa Beach, CA 90254****1. Executive Summary**

On October 3, 2022, Ellis conducted supplemental sampling for possible asbestos-containing materials at the subject site. Sampling and inspections were performed in the Clark Building prior to planned renovation activities – see photos and Figure 1. Past sampling efforts have been performed in the building by Envirocheck (2008), Patriot Environmental (2015), and by Ellis in (2017). This supplemental sampling effort was performed to fortify existing results for materials in the building for the purpose of meeting current SCAQMD Rule 1403 standards. Results are summarized below.

Asbestos**The following materials are asbestos-containing:**

1. asbestos-cement vent pipes
2. roof penetration mastics and sealants
3. vapor barrier beneath hardwood flooring (inaccessible and assumed)

No other materials were sampled. See “Results” section, Appendix A, and Table 1 for a complete list of asbestos-related samples.

Lead in Paint**The following paints are “lead-based” (>0.06 % lead by wt.):**

1. green door paint – women’s restroom
2. grey wall paint – kitchen
3. green paint on plaster baseboard – auditorium
4. yellow ceiling paint – kitchen
5. green wall paint – storage 2
6. beige closet paint – men’s restroom

A licensed abatement contractor is required for the removal or disturbance of the lead-based paints listed above. See “Results” section for more information. Also reference the “Results” section, Appendix A, and Table 2 for a complete list of lead-related samples.

This was not a complete hazardous materials survey; only client-specified locations and materials

were sampled. Any materials not identified in existing reports should be sampled prior to disturbance. The removal of asbestos- and lead-containing materials is regulated by SCAQMD Rule 1403 (asbestos only), Cal/OSHA Title 8 § 1529, Cal/OSHA Title 8 § 1532.1, and their federal regulatory counterparts. See attached regulatory summaries.

2. Methodology

All samples were collected by Lina Sok (CSST #15-5499, CDPH #2591), an EPA course-certified building inspector employed by Ellis. Each sample was placed in a sealed container and provided with a unique identifying number. Samples were transported to an EPA/NVLAP – accredited laboratory and analyzed by the following methods as appropriate for the sampled material:

- Asbestos. 40 CFR Part 763, Subpart F, Appendix A. (AHERA Final Rule). Results expressed in percent of measured area.
- Lead in Paint. Flame AAS (SW 846 EPA method 3050B/7000B). Results expressed in percent by weight.

3. Inaccessible Areas

Sampling was limited to client-specified materials and locations (only) – see drawings and Section 1 above. There is a chance that additional suspect materials (e.g. pipe insulation above hard ceilings) may be exposed during renovation or demolition efforts. Such materials, if not identified in existing reports, should be sampled and analyzed prior to disturbance.

4. Results

Refer to the attached drawing and laboratory analysis reports.

Asbestos

Asbestos was detected in the following sampled material:

1. asbestos-cement vent pipes – (5-15% chrysotile, good condition / “non-friable” – appx. 40 linear feet in qty.)*
2. roof penetration mastics and sealants – (6% chrysotile, good condition / “non-friable” – appx. 250 ft² in qty.)*
3. vapor barrier beneath hardwood flooring – (assumed, unknown condition – appx. 1,800 ft² in qty.)*

** Not for bidding purposes. Conditions noted are representative of observations on the date of sampling (only). Field verify all listed quantities and conditions.*

A licensed abatement contractor is required for the disturbance or removal of the asbestos-containing materials noted above.

No asbestos was detected in the following sampled materials:

1. exterior rolled-on roofing felts
2. exterior window putty
3. exterior stucco
4. exterior concrete wall / patching
5. concrete floor
6. interior wall / ceiling plaster

7. interior wallboard / joint compound (storage)
8. 2' x 4' ceiling tiles
9. cove base / associated mastic
10. brick / mortar

No other materials were sampled. See Table 1, Figure 1, and Appendix A for a complete list of sampled materials and their locations.

The removal of any material containing asbestos in an amount greater than one percent (Asbestos-Containing Material or ACM) is regulated under EPA-SCAQMD Rule 1403, 29 CFR 1926.1101 (federal OSHA) and other state and local guidelines. Removal of any material containing asbestos in an amount greater than 0.1 percent is also regulated, under Cal-OSHA Title 8 Section 1529. Asbestos-containing waste material (ACWM) generated during the removal of friable and non-friable ACM must be disposed of as hazardous asbestos waste and non-hazardous asbestos waste, respectively. For asbestos-containing materials with asbestos concentrations of less than 1% but greater than 0.1%, so called Asbestos-Containing Construction Materials or ACCM, waste generated during abatement activities may be disposed of as standard construction waste but must still be *removed* by a DOSH registered abatement contractor. Prior to renovation or demolition, retain a licensed abatement contractor to remove asbestos materials identified.

Lead

The following paints are “lead-based” (>0.06 % lead by wt.):

1. green door paint – women’s restroom (**0.22% lead by wt.**)
2. grey wall paint – kitchen (**0.16% lead by wt.**)
3. green paint on plaster baseboard – auditorium (**0.081% lead by wt.**)
4. yellow ceiling paint – kitchen (**0.37% lead by wt.**)
5. green wall paint – storage 2 (**0.13% lead by wt.**)
6. beige closet paint – men’s restroom (**0.29% lead by wt.**)

A licensed abatement contractor is required for the removal of disturbance of the lead-based paint listed above. Drum and profile all uniquely generated waste stream prior to transportation or disposal. See attached regulatory summaries for more information.

The following sampled paints are “lead-containing” (<0.06 % lead by wt.):

1. white wall paint on plaster – (0.041% lead by wt.)

Avoid torching, welding, or mechanical abrading on lead-containing paints without prior exposure monitoring as is stipulated in Cal/OSHA Title 8 § 1532.1. No other special, lead-related precautions required. Reference the attached lead “Trigger Tasks” document for additional information on “lead-based” (>.06%) and “lead-containing” (<.06%) paints and work practices.

No lead above regulated levels was identified in the following sampled paint:

1. green door frame paint - auditorium (<0.01% lead by wt.)
2. white door frame paint – auditorium (<0.01% lead by wt.)
3. grey wall paint – men’s & women’s restrooms (<0.01% lead by wt.)
4. green wall paint – exterior stucco (<0.01% lead by wt.)
5. white paint – exterior columns (<0.01% lead by wt.)

No other materials were sampled. See Table 1, Figure 1, and Appendix A for a complete list of sampled materials and their locations.

The disturbance of lead-containing materials is regulated by Cal/OSHA Title 8 § 1532.1, California Department of Public Health CDPH Title 17, and their federal regulatory counterparts. See attached regulatory summaries.

5. Statement of Independence

Ellis is a privately held company and is not affiliated with any financial institution or other corporate entity. Ellis is retained as an independent contractor to provide objective, impartial investigation or analytical services regarding environmentally regulated hazardous or toxic materials. This report is not an endorsement or rejection of any specific methods used in handling or transport of potentially hazardous chemicals. Nor is intended as a complete hazardous materials survey of the entire building or facility. Ellis provides independent testing for asbestos, lead, indoor air contaminants and other potentially hazardous materials. The company and its employees are certified and licensed to practice in the State of California. Retained laboratories are accredited by the EPA (AREAL), NIOSH (AIHA), and the California Air Resources Board (CARB).

Respectfully Submitted:
ELLIS ENVIRONMENTAL MANAGEMENT, INC.

Prepared by:



Lina Sok
Industrial Hygienist
CSST #15-5499
CDPH #2591

Proj. No.: 22-410

Reviewed by:



Ryan C. Davidson
Senior Project Manager
CAC #15-5395
CDPH #0368

Distribution: Jonathan Pascual

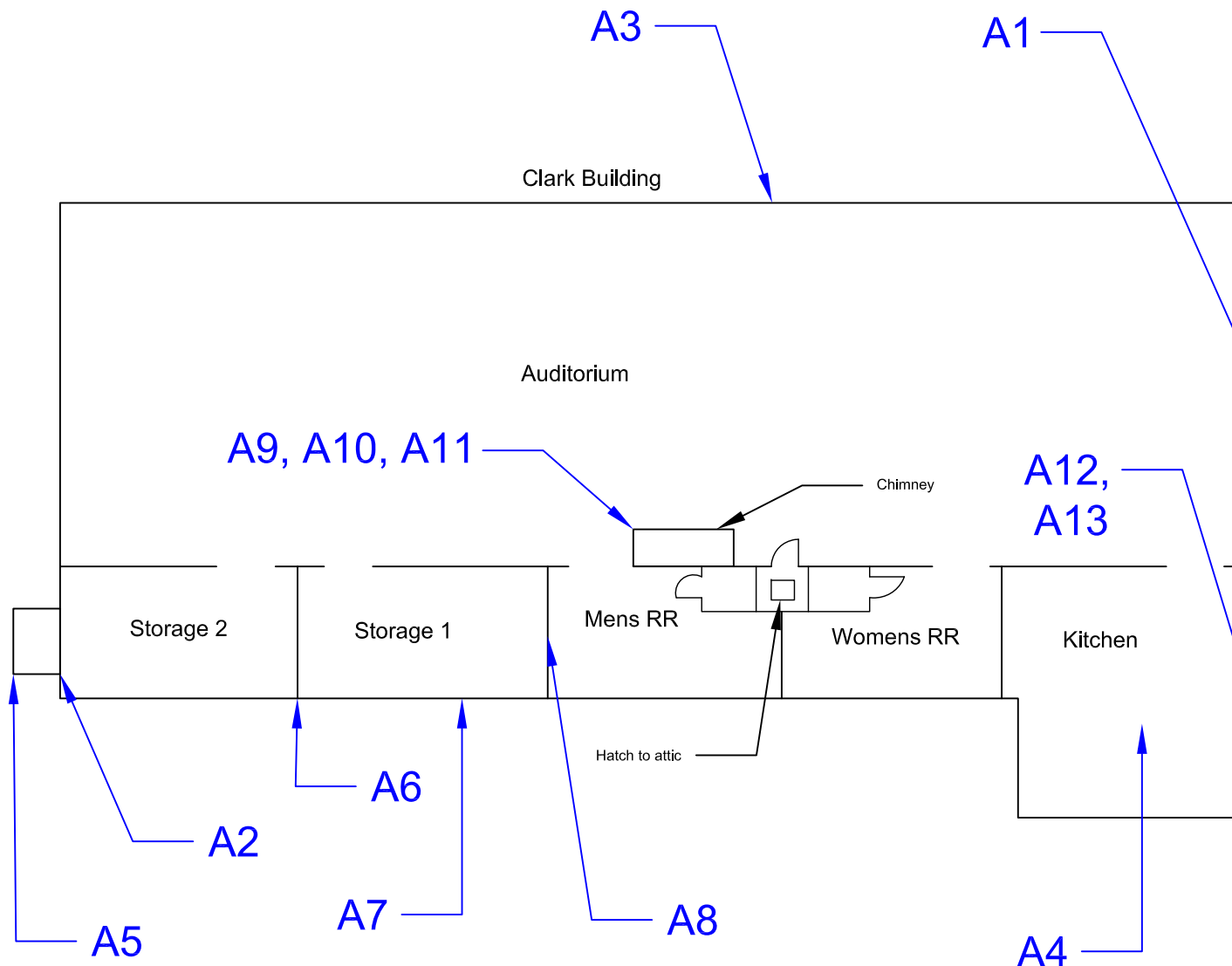


Figure 1: Sample Locations
 Clark Building
 861 Valley Dr., Hermosa Beach, CA

Firm Name and Address

Ellis Environmental Mgmt, Inc.
 430 Silver Spur Rd., Suite 201
 Rancho Palos Verdes, CA 90275

Client Name and Address

City of Hermosa Beach
 Clark Building
 861 Valley Dr.
 Hermosa Beach, CA

Project #

22-410

Date

10/6/2022

Sheet

1 of 1

Ellis

<u>REF.</u>	<u>MATERIAL</u>	<u>MATERIAL LOCATION</u>	<u>FRIABLE</u>	<u>DAMAGE</u>	<u>% ASB</u>	<u>QTY*</u>	<u>UNIT</u>
<u>IDENTIFIED ASBESTOS MATERIALS</u>							
Patriot Env. 2015	transite vent pipe	attic	no	no	5-15%	40	l.f.
Patriot Env. 2015	roof penetration mastics	lower and main roof penetrations	no	no	6%	250	s.f.
<i>*Not for bidding purposes. Field verify all quantities and conditions.</i>							
<u>ABATED ASBESTOS MATERIALS</u>							
17-454 (abated in 2017)	12" x 12" grey / green floor tile & associated mastic	kitchen	no	no	2-7%	450	l.f.
<u>NON-ASBESTOS MATERIALS</u>							
A1, A2, 81702A	exterior concrete wall	see Figure 1	-	-	none detected	-	-
A3, A4, A5	concrete floor	see Figure 1	-	-	none detected	-	-
A6, A7, 81710A	wallboard / joint compound (storage)	see Figure 1	-	-	none detected	-	-
A8, Patriot Env. 2015	grey cove base / associated mastic	see Figure 1	-	-	none detected	-	-
A9, A10, A11	brick / mortar	see Figure 1	-	-	none detected	-	-
A12, A13, 81701A	exterior stucco (kitchen)	see Figure 1	-	-	none detected	-	-
Not a complete survey; only client-specified materials were sampled.							

Table 1
Asbestos Results Summary
City of Hermosa Beach
Clark Building





AmeriSci Los Angeles

24416 S. Main Street, Ste 308
Carson, California 90745
TEL: (310) 834-4868 • FAX: (310) 834-4772

PLM Bulk Asbestos Report

Ellis Environmental Management, Inc.
Attn: Duane Behrens
430 Silver Spur Road
Suite 201
Rancho Palos Verdes, CA 90275

Date Received 10/03/22
Date Examined 10/05/22

AmeriSci Job # 922101023
P.O. #
Page 1 of 4

RE: 22-410; City Of Hermosa Beach; Clark BLDG. - 861 Valley Dr.
Hermosa Beach, 90254

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
A1 Location: Exterior Concrete Wall Analyst Description: Gray, Heterogeneous, Non-Fibrous, Cementitious, Concrete Asbestos Types: Other Material: Non-fibrous 100%	922101023-01	No	NAD (by CVES) by Francis Paras on 10/05/22
A2 Location: Exterior Concrete Wall Analyst Description: Gray/Green/White, Heterogeneous, Non-Fibrous, Cementitious, Concrete Asbestos Types: Other Material: Non-fibrous 100%	922101023-02	No	NAD (by CVES) by Francis Paras on 10/05/22
A3 Location: Concrete Floor Analyst Description: Gray, Heterogeneous, Non-Fibrous, Cementitious, Concrete Asbestos Types: Other Material: Non-fibrous 100%	922101023-03	No	NAD (by CVES) by Francis Paras on 10/05/22
A4 Location: Concrete Floor Analyst Description: Gray, Heterogeneous, Non-Fibrous, Cementitious, Concrete Asbestos Types: Other Material: Non-fibrous 100%	922101023-04	No	NAD (by CVES) by Francis Paras on 10/05/22
A5 Location: Concrete Floor Analyst Description: Gray, Heterogeneous, Non-Fibrous, Cementitious, Concrete Asbestos Types: Other Material: Non-fibrous 100%	922101023-05	No	NAD (by CVES) by Francis Paras on 10/05/22

Client Name: Ellis Environmental Management, Inc.

PLM Bulk Asbestos Report22-410; City Of Hermosa Beach; Clark BLDG. - 861 Valley Dr.
Hermosa Beach, 90254

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
A6 Location: WB/JC - Storage 1	922101023-06.1	No	NAD (by CVES) by Francis Paras on 10/05/22
Analyst Description: Off-White, Heterogeneous, Non-Fibrous, Joint Compound Asbestos Types: Other Material: Non-fibrous 100%			
A6 Location: WB/JC - Storage 1	922101023-06.2	No	NAD (by CVES) by Francis Paras on 10/05/22
Analyst Description: White, Heterogeneous, Fibrous, Wall Board Asbestos Types: Other Material: Fibrous glass 5%, Non-fibrous 95%			
A7 Location: WB/JC - Storage 1	922101023-07.1	No	NAD (by CVES) by Francis Paras on 10/05/22
Analyst Description: Off-White, Heterogeneous, Non-Fibrous, Joint Compound Asbestos Types: Other Material: Non-fibrous 100%			
A7 Location: WB/JC - Storage 1	922101023-07.2	No	NAD (by CVES) by Francis Paras on 10/05/22
Analyst Description: White, Heterogeneous, Fibrous, Wall Board Asbestos Types: Other Material: Fibrous glass 5%, Non-fibrous 95%			
A8 Location: Grey Cove Base/Mastic	922101023-08L1	No	NAD (by CVES) by Francis Paras on 10/05/22
Analyst Description: Gray , Homogeneous, Non-Fibrous, Cove Base Asbestos Types: Other Material: Non-fibrous 100%			
A8 Location: Grey Cove Base/Mastic	922101023-08L2	No	NAD (by CVES) by Francis Paras on 10/05/22
Analyst Description: Gray, Homogeneous, Non-Fibrous, Mastic Asbestos Types: Other Material: Non-fibrous 100%			

Client Name: Ellis Environmental Management, Inc.

PLM Bulk Asbestos Report

22-410; City Of Hermosa Beach; Clark BLDG. - 861 Valley Dr.
Hermosa Beach, 90254

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
A9 Location: Brick/Mortar Analyst Description: Red, Heterogeneous, Non-Fibrous, Cementitious, Brick Asbestos Types: Other Material: Non-fibrous 100%	922101023-09.1	No	NAD (by CVES) by Francis Paras on 10/05/22
A9 Location: Brick/Mortar Analyst Description: Gray, Heterogeneous, Non-Fibrous, Cementitious, Mortar Asbestos Types: Other Material: Non-fibrous 100%	922101023-09.2	No	NAD (by CVES) by Francis Paras on 10/05/22
A10 Location: Brick/Mortar Analyst Description: Red, Heterogeneous, Non-Fibrous, Cementitious, Brick Asbestos Types: Other Material: Non-fibrous 100%	922101023-10.1	No	NAD (by CVES) by Francis Paras on 10/05/22
A10 Location: Brick/Mortar Analyst Description: Gray, Heterogeneous, Non-Fibrous, Cementitious, Mortar Asbestos Types: Other Material: Non-fibrous 100%	922101023-10.2	No	NAD (by CVES) by Francis Paras on 10/05/22
A11 Location: Brick/Mortar Analyst Description: Red, Heterogeneous, Non-Fibrous, Cementitious, Brick Asbestos Types: Other Material: Non-fibrous 100%	922101023-11.1	No	NAD (by CVES) by Francis Paras on 10/05/22
A11 Location: Brick/Mortar Analyst Description: Gray, Heterogeneous, Non-Fibrous, Cementitious, Mortar Asbestos Types: Other Material: Non-fibrous 100%	922101023-11.2	No	NAD (by CVES) by Francis Paras on 10/05/22

Client Name: Ellis Environmental Management, Inc.

PLM Bulk Asbestos Report

22-410; City Of Hermosa Beach; Clark BLDG. - 861 Valley Dr.
Hermosa Beach, 90254

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
A12 Location: Exterior Stucco - Kitchen	922101023-12	No	NAD (by CVES) by Francis Paras on 10/05/22
Analyst Description: Gray/Beige, Heterogeneous, Non-Fibrous, Cementitious, Stucco Asbestos Types: Other Material: Non-fibrous 100%			
A13 Location: Exterior Stucco - Kitchen	922101023-13	No	NAD (by CVES) by Francis Paras on 10/05/22
Analyst Description: Gray/Beige, Heterogeneous, Non-Fibrous, Cementitious, Stucco Asbestos Types: Other Material: Non-fibrous 100%			

Reporting Notes:

Analyzed by: Francis Paras
Date: 10/5/2022



Reviewed by: Patricia Weakley



*NAD = no asbestos detected; Detection Limit <1%; Reporting Limits: CVES = 1%, 400 Pt Ct = 0.25%, 1000 Pt Ct = 0.1%; NA = not analyzed; NA/PS = not analyzed / positive stop; NVA = No Visible Asbestos; PLM (polarized light microscopy) Bulk Asbestos Analysis by EPA 600/R-93/116, including requirements for EPA 600/M4-82-020 per 40 CFR 763 (NVLAP Lab #200346-0); Note: PLM is not consistently reliable in detecting asbestos in floor coverings and similar NOB materials. TEM is currently the only method that can be used to determine if this material can be considered or treated as non-asbestos-containing in New York State (also see EPA Advisory for floor tile, FR 59, 146, 38970, 8/1/94). NIST Accreditation requirements mandate that this report must not be reproduced except in full with the approval of the laboratory. This PLM report relates ONLY to the items tested.

922101023



Project No.: 22-410

Sampler: LS

Client: CITY OF HERMOSA BEACH

430 Silver Spur Road, Suite 201
Rancho Palos Verdes, CA 90275

Sheet 1 of 1

Location: CLARK BLDG.

(310) 544-1837 (tel)
(310) 544-2167 (fax)

861 VALLEY DR. HERMOSA BEACH, 90254

CHAIN OF CUSTODY RECORD

Sample Number	Description	QTY Sq. Ft	Date	Time	H 2 0	A i r	S o l i d	Stop At First Positive Layer	Tests Required
A1	EXTERIOR CONCRETE WALL	5,000	10/3/22	AM			X	X	PLM - ASBESTOS
A2	↓								
A3	CONCRETE FLOOR	1,500							
A4	↓								
A5	↓								
A6	WB/IC - STORAGE 1	200							
A7	↓								
A8	GREY COVE BASE/MASTIC	10							
A9	BRICK/MORTAR	200							
A10	↓								
A11	↓								
A12	EXTERIOR STUCCO - KITCHEN	500							
A13	↓								

Turnaround: same day 24 hrs. 48 hrs. 3 days 5 days (Standard) 2 weeks

Special Instructions:

Date	Time	Relinquished By: Signature / Printed Name	Received By
10/3/22	11:25	LINA SOK	Glenda Wason 10-3-22 11:20

State of California
Division of Occupational Safety and Health
Certified Site Surveillance Technician



Lina Sok

Name

Certification No. 15-5499

Expires on 11/17/22

This certification was issued by the Division of Occupational Safety and Health as authorized by Sections 7180 et seq. of the Business and Professions Code.



STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC HEALTH



LEAD-RELATED CONSTRUCTION CERTIFICATE

INDIVIDUAL:

CERTIFICATE TYPE:

NUMBER:

EXPIRATION DATE:



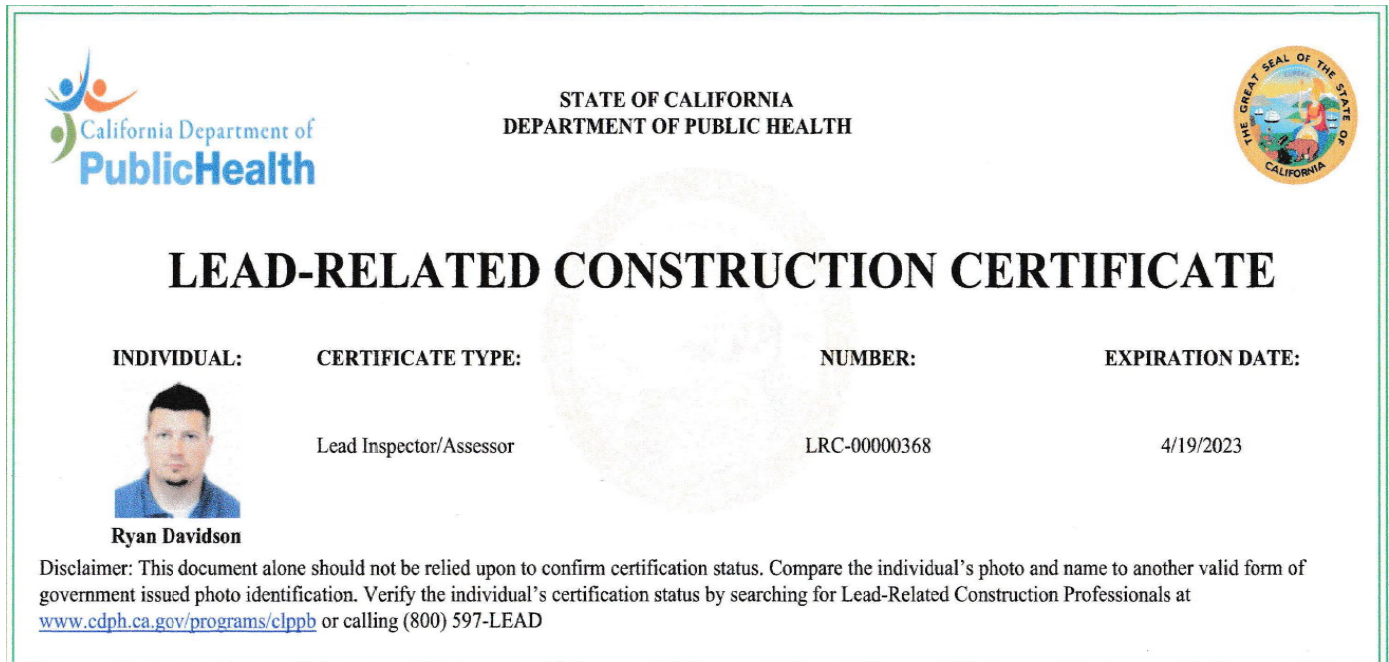
Lead Sampling Technician

LRC-00002591

12/29/2022

Lina Sok

Disclaimer: This document alone should not be relied upon to confirm certification status. Compare the individual's photo and name to another valid form of government issued photo identification. Verify the individual's certification status by searching for Lead-Related Construction Professionals at www.cdph.ca.gov/programs/clppb or calling (800) 597-LEAD



APPLICABLE REGULATIONS – LEAD

California Title 8, Industrial Relations, Division 1, Department of Industrial Relations, Chapter 4, Division of Industrial Safety, Subchapter 4, Construction Safety Orders, Article 4, Dusts, Fumes, Mists, Vapors, and Gases, §1532.1, Lead.

This section applies to all construction work where an employee may be occupationally exposed to lead. All construction work excluded from coverage in the general industry standard for lead by section 5198(a)(2) is covered by this standard. Construction work is defined as work for construction, alteration and/or repair, including painting and decorating. It includes but is not limited to the following:

- (1) Demolition or salvage of structures where lead or materials containing lead are present;
- (2) Removal or encapsulation of materials containing lead;
- (3) New construction, alteration, repair, or renovation of structures, substrates, or portions thereof, that contain lead, or materials containing lead;
- (4) Installation of products containing lead;
- (5) Lead contamination/emergency cleanup;
- (6) Transportation, disposal, storage, or containment of lead or materials containing lead on the site or location at which construction activities are performed, and
- (7) Maintenance operations associated with the construction activities described in this subsection.

California Health & Safety Code 17961 et al.

Deems a building to be in violation of state law if it contains lead hazards, and requires local enforcement agencies to enforce provisions related to lead hazards. Makes it a crime for a person to engage in specified acts related to lead hazard evaluation, abatement, and lead-related construction courses unless certified or accredited by the Department. Permits local enforcement agencies to order the abatement of lead hazards or issue a cease and desist order in response to lead hazards.

California Labor Code 6716 to 6717 Lead-Related Activities in Construction Work

Provides for the establishment of standards that protect the health and safety of employees who engage in lead-related construction work, including construction, demolition, renovation and repair.

California Code of Regulations, Title 17, Section 35001

Includes requirements for lead hazard evaluation and abatement activities, accreditation of training providers, and certification of individuals engaged in lead-based paint activities.

LEAD - "TRIGGER TASKS"

(SOURCE: California Title 8 Section 1532.1.)

Following testing, Construction Managers and Superintendents may use the following to decide whether (and for how long) an abatement contractor should be retained during disturbance of painted surfaces.

Paint Categories

1. Lead-Based. >.06% Lead by Weight. Start-to-finish, retain an abatement contractor to perform trigger tasks listed below.
2. Lead-Containing. 0.009 – 0.06% lead by weight. Avoid torching or mechanical grinding; no other special precautions.
3. Non-Lead-Containing <.009% lead by weight. No special lead-related precautions required.

TRIGGER TASKS - Lead-Based Paints Only:

Lowest Exposure Trigger Tasks:

Unless proven otherwise (Negative Exposure Assessment, or "NEA"), assume exposures greater than 50 and up to 500 µg/m³ where lead-based coatings or paint are present:

- manual demolition of structures
- manual scraping
- manual sanding
- heat gun applications
- power tool cleaning with dust collection system
- spray painting with lead
- any other task where employees may be exposed over the PEL.

Medium Exposure Trigger Tasks:

Unless proven otherwise (NEA), assume exposures greater than 500 and up to 2,500 µg/m³ where lead-based coatings or paint are present:

- use of lead-containing mortar
- lead burning
- rivet busting
- power tool cleaning without dust collection systems
- cleanup of dry expendable abrasives
- abrasive blasting enclosure movement and removal

Highest Exposure Trigger Tasks:

Assume exposures greater than 2,500 µg/m³ unless proven otherwise where lead-based coatings or paint are present:

- abrasive blasting
- welding
- cutting
- torch burning

APPLICABLE REGULATIONS – ASBESTOS

Current state and federal regulations pertaining to asbestos are summarized below. The summary is not all-inclusive, and does not address specific removal or disposal requirements for individual materials.

NESHAPS

The National Emission Standard for Hazardous Air Pollutants (NESHAP), regulation 40 CFR Part 61, states that no visible emissions are allowed during building demolition or renovation activities which involve regulated asbestos-containing materials (RACMs). All buildings, regardless of construction date, must be surveyed for ACMs prior to demolition or renovation. The US EPA and/or the local air quality management district which implements US EPA actions must be notified prior to any building demolition, even if no ACMs are present. An ACM is defined as any material with an asbestos content of greater than one percent and which (a) is friable, or (b) Category I non-friable ACM that has or will become friable, or (c) Category II friable ACM that may become or will become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation.

According to NESHAP, ACM is material containing more than one percent asbestos as determined using the methods specified in Appendix A, Subpart E, 40 CFR Part 763, Section 1, PLM. The NESHAP classifies ACM as friable or non-friable. Friable ACM is ACM that contains more than one percent asbestos and when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

Non-friable ACM also contains more than one percent asbestos and is further classified as either Category I ACM or Category II ACM. The materials are distinguished by their potential to release fibers when damaged. Category I ACMs are much more likely to release fibers when damaged.

In accordance with the US EPA's NESHAP regulation, facilities planned for renovation or demolition must be surveyed for the total amount of asbestos materials, which must be categorized as friable, Category 1 non-friable, and Category 2 non-friable ACMs.

Southern California Air Quality Management District (SCAQMD)

The SCAQMD is a government agency that regulates sources of air pollution within the area of the Los Angeles and surrounding counties. The District's regulating and enforcement authority comes from federal law. In response to the NESHAP requirements, the SCAQMD implemented Rule 1403 to specify work practice requirements to limit asbestos emissions from building demolition and renovation activities, including the removal and associated disturbance of asbestos-containing materials (ACM). The requirements for demolition and renovation activities include asbestos surveying, notification, ACM removal procedures and time schedules, ACM handling and clean-up procedures, and storage, disposal, and landfilling requirements for asbestos-containing waste materials (ACWM). All operators are required to maintain records, including waste shipment records, and are required to use appropriate warning labels, signs, and markings.

AHERA

The Asbestos Hazard Emergency Response Act (AHERA) requires performance of asbestos surveys and the development of Asbestos Management Plans for all of the nation's primary and secondary schools. The general procedures mandated under AHERA are considered the industry standard and are applied to all surveys performed.

Cal-OSHA

Per Cal-OSHA standards, 1926.1101, Asbestos-Containing Construction Materials (ACCMs) are defined as any material with an asbestos content greater than one-tenth of one percent (>0.1%). Cal-OSHA sets forth work requirements for disturbance of ACCMs including removal operations for all types of ACCMs. The requirements have been classified as Class I, Class II, Class III, or Class IV Asbestos related work. The classes are distinguished by their potential to release fibers. Cal-OSHA prescribes specific engineering controls and work practices for each Class of Asbestos related Work.

1. Class I – This Class refers to removal of ACCMs identified as Thermal System Insulation (TSI) or surfacing (sprayed-on or troweled-on) materials. These materials are generally considered friable.
2. Class II – This Class refers to removal of ACCMs identified that are not TSI or surfacing materials. These materials are generally considered non-friable.
3. Class III – This Class refers to repair and maintenance operations of all identified ACCMs.
4. Class IV – This Class refers to incidental contact with identified ACCMs such as custodial staff.

California Health and Safety Code

The California Health and Safety Code 25915 (former Connolly Bill) requires all building owners in the State of California to provide written notification to employees, tenants, and contractors of the presence and location of ACCMs within their buildings. Some exclusion to the notification rule for restricted access areas is allowed. All documentation related to asbestos surveys (and air monitoring) must be made available to employees, tenants, or contractors for review. ACCMs are defined as any materials with an asbestos content greater than one-tenth of one percent (>0.1%). The California Health and Safety Code also require that a seller with any knowledge of ACCMs on a property disclose such information or knowledge to other parties involved in a real estate transaction.

Building Demolition / Renovation

In accordance with the US EPA's NESHAPs regulation and the SCAQMD, all structures planned for renovation or demolition must be surveyed for ACCMs prior to the planned renovation or demolition. Subsequent removal of identified ACCMs is also required. Removal involves, to the greatest extent practical, the complete removal, disposal, and replacement, if necessary, of the ACCMs. Removal usually also requires encapsulation of the remaining structure to lock down residual fibers which may exist. Removal of ACCMs is required prior to renovation and/or demolition activities. The US EPA and SCAQMD require removal of all RACMs prior to demolition or renovation. RACMs include friable and non-friable (Category I and II) which have or will become friable by demolition or renovation activities.

Appendix A

Past Sampling Reports

Past Abatement Monitoring Reports

Hazardous Materials Assessment

- Asbestos
- Lead

**The Clark Building
861 Valley Drive
Hermosa Beach**

**Sampling Date: August 17, 2017
Project No: 17-312**



Prepared for:
The City of Hermosa Beach

Prepared by:
*Ellis Environmental Management, Inc.
430 Silver Spur Road, Suite 201
Rancho Palos Verdes, CA 90275
310 544 1837 / www.ellisenvironmental.com*

Terms of Use

Ellis Environmental Management, Inc has prepared this report for the exclusive use of

The City of Hermosa Beach

Ellis will distribute any information regarding this assessment and report only upon the request of the client. This report is based upon data and information obtained during the site visits performed by Ellis personnel for the property identified herein within the time frames allowed. It is based solely upon the condition of the property on the date of such inspection, supplemented by information and data obtained by Ellis and described herein. Information presented is based on professional interpretation of data available as of the month prior to the date of report. Physical testing of subsurface soils or structures was not performed as part of this assessment. No opinion or warranty is made regarding the existence or location of underground structures or potential contaminants, whether stored or released. In evaluating the property, Ellis has relied in good faith upon representations and information furnished by individuals and agencies noted in the report with respect to operations and existing property conditions, and the historic uses of the property to the extent that they have not been contradicted by data obtained from other sources. Use of this report indicates acceptance and agreement that Ellis will incur no responsibility or liability for any loss, injury, claim or damage arising directly or indirectly from any use or reliance on this report, regardless of whether claimed loss, injury, claim or damage was caused by the deficiency, misstatements, omissions, misinterpretations, or fraudulent acts of persons interviewed. Ellis has performed this work, made findings, and proposed recommendations described in this report in accordance with generally accepted environmental science practices for asbestos and lead-paint surveys in effect at the time the work was performed and within requested time frames. Additional information received following issuance of the report may alter initial findings and recommendations. This warranty stands in lieu of all other warranties, expressed or implied. While this report can be used as a guide, it must be understood that it is neither a rejection nor an endorsement of the property, or of the means or methods used in the treatment, storage or disposal of potentially hazardous materials. Changing circumstances in the environment and in the use of the property can alter the conclusions and information contained in the report.

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Site Description
Background
Applicable Regulations – Asbestos
Applicable Regulations – Lead
Methodology
Inaccessible Areas
Results
Summary and Recommendations
Statement of Independence
Signatory

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Table 2 – Lead XRF Summary

Appendix A Material and Sample Locations
Appendix B Laboratory Results – Asbestos
Appendix C Laboratory Results - Lead
Appendix D Ellis / Lab Certifications
Appendix E Lead “Trigger Tasks”
CDPH Form 8552

Project No. 17-312

August 24, 2017

Ms. Liz Zeigler
Management Analyst
Public Works Department
City of Hermosa Beach

Subject: ASBESTOS AND LEAD SURVEY REPORT
THE CLARK BUILDING
861 VALLEY DRIVE
HERMOSA BEACH

INTRODUCTION

On August 17, 2017, Ellis conducted an inspection for possible asbestos-containing and lead-based materials at the subject site. All samples were collected by Duane Behrens, Lina Sok and Sonny Baramy, EPA- and CDPH-accredited building inspectors employed by Ellis. The sampling was conducted prior to planned interior renovation activities.

To the best of our knowledge, this survey and report have been prepared to include the following asbestos- and lead-specific components:

- a. survey sampling protocol to include collection, sampling and analysis methods
- b. initial characterization of asbestos waste stream(s)
- c. certification of the inspector as a CSST
- d. certification of the inspector as a CDPH lead inspector/assessor
- e. certification of the report preparer as a CAC
- f. certification of the report preparer as a CDPH lead inspector/assessor
- g. state laboratory certification

SITE DESCRIPTION

Building Description: The structure at the subject site was conceived and built as a community meeting hall in 1936. High ceilings, large windows and a hardwood floor make this an attractive venue for numerous local events. Floors are hardwood. Walls are concrete. The wooden roof has a barrel shape typical of buildings of this period. Total interior area of the building is approximately 4800 s.f., including a large auditorium and stage, kitchen, 2 restrooms and 2 storage rooms.



BACKGROUND

Asbestos-containing materials and lead-based paints have been widely used in the construction of public and commercial buildings since the 1930s. Insulation and fireproofing in more than 750,000 buildings in this country contain some quantity of asbestos. Lead paint was widely applied up until circa 1978, when concentrations of lead in paint began to be reduced.

In their normal state, most types of asbestos-containing building materials are unlikely to release airborne fibers. When broken up or disturbed improperly, however, asbestos fibers may become airborne. “Friable” materials – that is, materials that can be crushed using normal hand pressure – are more likely to release airborne fibers when disturbed improperly. Inhalation exposure to high levels of asbestos over long periods and/or ingestion of lead-based paint are associated with an increased incidence of cancer, respiratory, liver and other diseases.

Asbestos is primarily an inhalation hazard. Lead-based paint, when damaged (peeling or flaking), is primarily an ingestion hazard. Any activity that could disturb asbestos materials or lead-based paint should be undertaken with care and in accordance with applicable law.

APPLICABLE REGULATIONS – ASBESTOS

Current state and federal regulations pertaining to asbestos are summarized below. The summary is not all-inclusive, and does not address specific removal or disposal requirements for individual materials.

NESHAPS

The National Emission Standard for Hazardous Air Pollutants (NESHAP), regulation 40 CFR Part 61, states that no visible emissions are allowed during building demolition or renovation activities which involve regulated asbestos-containing materials (RACMs). All buildings, regardless of construction date, must be surveyed for ACMs prior to demolition or renovation. The US EPA and/or the local air quality management district which implements US EPA actions must be notified prior to any building demolition, even if no ACMs are present. An ACM is defined as any material with an asbestos content of greater than one percent and which (a) is friable, or (b) Category I non-friable ACM that has or will become friable, or (c) Category II friable ACM that may become or will become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation.

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Cal-OSHA

Per Cal-OSHA standards, 1926.1101, Asbestos-Containing Construction Materials (ACCMs) are defined as any material with an asbestos content greater than one-tenth of one percent (>0.1%). Cal-OSHA sets forth work requirements for disturbance of ACCMs including removal operations for all types of ACCMs. The requirements have been classified as Class I, Class II, Class III, or Class IV Asbestos related work. The classes are distinguished by their potential to release fibers. Cal-OSHA prescribes specific engineering controls and work practices for each Class of Asbestos related Work.

1. Class I – This Class refers to removal of ACMs identified as Thermal System Insulation (TSI) or surfacing (sprayed-on or troweled-on) materials. These materials are generally considered friable.
2. Class II – This Class refers to removal of ACMs identified that are not TSI or surfacing materials. These materials are generally considered non-friable.
3. Class III – This Class refers to repair and maintenance operations of all identified ACMs.
4. Class IV – This Class refers to incidental contact with identified ACMs such as custodial staff.

California Health and Safety Code

The California Health and Safety Code 25915 (former Connelly Bill) requires all building owners in the State of California to provide written notification to employees, tenants, and contractors of the presence and location of ACCMs within their buildings. Some exclusion to the notification rule for restricted access areas is allowed. All documentation related to asbestos surveys (and air monitoring) must be made available to employees, tenants, or contractors for review. ACCMs are defined as any materials with an asbestos content greater than one-tenth of one percent (>0.1%). The California Health and Safety Code also require that a seller with any knowledge of ACMs on a property disclose such information or knowledge to other parties involved in a real estate transaction.

Building Demolition / Renovation

In accordance with the US EPA's NESHAPs regulation and the SCAQMD, all structures planned for renovation or demolition must be surveyed for ACMs prior to the planned renovation or demolition. Subsequent removal of identified ACMs is also required. Removal involves, to the greatest extent practical, the complete removal, disposal, and replacement, if necessary, of the ACMs. Removal usually also requires encapsulation of the remaining structure to lock down residual fibers which may exist. Removal of ACMs is required prior to renovation and/or demolition activities. The US EPA and SCAQMD require removal of all RACMs prior to demolition or renovation. RACMs include friable and non-friable (Category I and II) which have or will become friable by demolition or renovation activities.

APPLICABLE REGULATIONS – LEAD

California Title 8. Industrial Relations, Division 1, Department of Industrial Relations, Chapter 4, Division of Industrial Safety, Subchapter 4, Construction Safety Orders, Article 4, Dusts, Fumes, Mists, Vapors, and Gases, §1532.1, Lead.

This section applies to all construction work where an employee may be occupationally exposed to lead. All construction work excluded from coverage in the general industry standard for lead by

section 5198(a)(2) is covered by this standard. Construction work is defined as work for construction, alteration and/or repair, including painting and decorating. It includes but is not limited to the following [applicable portions in bold text]:

- (1) Demolition or salvage of structures where lead or materials containing lead are present;
- (2) Removal or encapsulation of materials containing lead;
- (3) New construction, alteration, repair, or renovation of structures, substrates, or portions thereof, that contain lead, or materials containing lead;
- (4) Installation of products containing lead;
- (5) Lead contamination/emergency cleanup;
- (6) Transportation, disposal, storage, or containment of lead or materials containing lead on the site or location at which construction activities are performed, and
- (7) Maintenance operations associated with the construction activities described in this subsection.

California Health & Safety Code 17961 et al.

Deems a building to be in violation of state law if it contains lead hazards, and requires local enforcement agencies to enforce provisions related to lead hazards. Makes it a crime for a person to engage in specified acts related to lead hazard evaluation, abatement, and lead-related construction courses unless certified or accredited by the Department. Permits local enforcement agencies to order the abatement of lead hazards or issue a cease and desist order in response to lead hazards.

California Labor Code 6716 to 6717 Lead-Related Activities in Construction Work

Provides for the establishment of standards that protect the health and safety of employees who engage in lead-related construction work, including construction, demolition, renovation and repair.

California Code of Regulations, Title 17, Section 35001

Includes requirements for lead hazard evaluation and abatement activities, accreditation of training providers, and certification of individuals engaged in lead-based paint activities.

METHODOLOGY

Bulk Sampling of Suspect Asbestos-Containing Materials

A sampling plan was first prepared, listing each material to be sampled, sample location, and material condition. Accessible building materials were visually inspected using the methods presented in the Federal Asbestos Hazard Emergency Response Act (AHERA) regulations (40 CFR, Part 763) as a guideline. AHERA was originally only applicable to schools; however, state and federal Occupational Safety and Health Administration (OSHA) and Asbestos School Hazard Abatement and Reauthorization Act (ASHARA) have adopted the AHERA sampling methodology for all buildings subject to demolition or renovation.

Bulk samples of all suspect ACM homogeneous materials were collected. A homogeneous material is defined as a surfacing material, thermal system insulation, or miscellaneous material that is uniform in color, texture and age of construction. Examples of homogeneous materials include:

- Pipe-insulation produced by the same manufacturer and installed during the same time period;
- Resilient flooring of identical color and pattern;
- Troweled on surfacing materials located in contiguous areas.

The structure was visually inspected for the presence of suspect materials. As materials were identified, bulk samples were obtained with the aid of a coring device or other hand tool and placed into individual sampling bags. Each sample was given a discrete identification number and recorded on field notes as well as chain-of-custody forms. Bulk samples were transported to and analyzed at AmeriSci Laboratories in Carson California. Analysis method used: 40 CFR Part 763, Subpart F, Appendix A. (AHERA Final Rule). Results expressed in percent of measured area.

Cal-OSHA defines asbestos-containing construction materials (ACCM) as those materials having asbestos content of greater than one tenth of one percent (>0.1%). When None Detected (ND) appears in this report, it should be interpreted as meaning no asbestos was observed in the sample material above the reliable limit of detection for the PLM method employed.

Note: under EPA assessment criteria, if a single sample of a homogeneous material tests positive for asbestos, all homogeneous materials within that building are considered to be asbestos-containing.

Bulk Sampling of Suspect Lead Containing Materials

An XRF lead paint analyzer was first used to identify those surfaces with significant lead content. It is often unnecessary to collect physical samples of surfaces in which lead was identified by XRF, thus potentially reducing field time and laboratory costs.

For negative or inconclusive XRF shots, samples were collected using a hand scraper, small chisel or other tool. Each sample was placed into an individual plastic sample container with a unique identification number. Paint samples were hand delivered to AmeriSci Laboratories in Carson California for initial analysis using EPA Method SW846-3050B-7000B, then later by EPA Method 6010 in combination with WET (TTLC) and TCLP methods to assist in initial waste profiling efforts. (When “<” appears in the lead analysis report, it should be interpreted as meaning below the analytical detection limit.) All samples were collected under the direct supervision of

Duane Behrens, an EPA-accredited building inspector and a lead inspector/assessor employed by Ellis.

INACCESSIBLE AREAS

Not all walls, ceilings or floors were demolished to gain complete visual access. There is a chance that suspect materials (pipe insulation in walls, asbestos-cement vent pipes, underground drains, etc.) will be exposed during renovation activities. Suspect materials exposed but not identified in this report should be sampled prior to disturbance.

RESULTS

See Table 1. Also refer to the attached laboratory results. Results are summarized below.

Asbestos

Asbestos was identified or is assumed present in the following materials, Items 1 – 4 below. Quantities shown are estimates and are not for bidding purposes. Field verify all quantities.

1. 12” flooring/mastic, kitchen – gray, beige, green. Non-friable. “Good” condition. 450 s.f.



12” flooring and mastic, kitchen

2. Felt paper under auditorium floor. Assumed positive. Inaccessible. 1800 s.f.



Concealed felt paper under auditorium floor – assumed positive.

3. [not shown] Roofing mastics. Good condition. Non-friable. 50 l.f. app.
4. Asbestos-cement pipes in attic. Non-friable. Good condition. No damage. 40 l.f.



Asbestos-cement pipes, attic.

No asbestos was detected in other materials sampled at this location, listed below:

Non-Asbestos Materials.

- Exterior rolled-on roofing felts
- Exterior window putty
- Exterior stucco
- Exterior concrete patching
- Interior wall and ceiling plaster
- Interior wallboard, storage
- 2' x 4' ceiling tiles
- Cove base and mastic

Asbestos Waste Stream Characterization: If removed by hand methods, flooring and roofing materials may be removed, transported and disposed of as non-friable asbestos-containing waste. If confirmed as asbestos, felt paper under the auditorium floor will be considered friable. Removal of any material containing asbestos in an amount greater than one percent is regulated under EPA-SCAQMD Rule 1403, 29 CFR 1926.1101 (federal OSHA) and other state and local guidelines. Removal of any material containing asbestos in an amount greater than 0.1 percent is regulated under Cal-OSHA Title 8 Section 1529.

Lead-Containing Materials

The following lead-based or lead-containing materials were identified:

1. Red primer on structural steel. Inaccessible for sampling, assumed lead-based. The material appeared in good condition. Retain an abatement contractor to perform spot abatement prior to any welding or torch cutting.



Primer on structural steel – assumed lead-based.

2. Gray paint, kitchen walls and cabinets. Slight damage. Retain an abatement contractor to perform any wall demolition here AFTER stabilizing loose and flaking paint.



Gray paint on kitchen walls and cabinets– lead-based.

3. Green paint on ceilings, walls and baseboard, kitchen and storage Room 2. Retain an abatement contractor to perform any required demolition. Profile generated waste prior to disposal.



Green paint, ceilings, walls and baseboard. Lead-based.

4. Yellow ceiling paint, kitchen (above suspended ceiling). No apparent damage. Retain an abatement contractor to perform any required demolition. Profile waste for lead prior to disposal.



Yellow paint above north kitchen sub-ceiling. Lead-based.

5. Yellow ceramic tile, men's room storage. Retain an abatement contractor to perform any required demolition. Profile generated waste prior to disposal.



Lead-based ceramic tile, men's restroom storage (former shower).

6. (not shown) Original door casings, old storage areas. Retain an abatement contractor to perform any required demolition. Profile generated waste prior to disposal.

Any damaged (peeling and flaking) paint should be stabilized by a licensed abatement contractor prior to disturbance or demolition. Remove stabilized components in whole sections and profile representative generated waste prior to transport or disposal. No other precautions are required unless one or more of the attached “Lead Trigger Tasks” are employed.

SUMMARY AND RECOMMENDATIONS

Asbestos

If they will be impacted by planned renovation, a licensed abatement contractor should be retained to first remove asbestos materials identified in this report.

Initiate any interior wall and ceiling demolition carefully. Look for concealed pipe insulation; sample for asbestos prior to disturbance.

Subsurface materials, such as asbestos-cement (AC, or “Transite”) *may* be present. A review of existing utility plans may reveal their presence, location and quantity. AC pipe, when exposed during grading activities, must be removed under an SCAQMD-approved work plan (“Procedure 5”).

Lead

Lead is assumed present on structural steel (red primer), various original paints (green, yellow and gray), original door frames, and in ceramic tile in the men’s storage room. During demolition, do not grind or torch cut without first performing spot abatement at cut points. Retain an abatement contractor to perform any “Trigger Tasks” as outlined in the attached. Profile generated waste prior to disposal.

Other

There is a 4” diameter hole in the roof, visible from within the attic. Water has already entered the building and has caused mold issues in the rear storage area (see related report 17-312). This should be repaired and sealed immediately, prior to initiating mold remediation efforts.

Health and Safety Plan (HaSP)

A health and safety plan, or HaSP, is a plan for a workplace that is designed in accordance with the legislative requirements covering the roles and responsibilities of the staff, an emergency action plan etc. A health and safety plan is designed to serve and protect the individuals affected by the organization in all matters of health, wellbeing and safety.

The HaSP is required for this project site. It must be specific to the job site and will include the unique, potential hazards associated with this site. A “site specific” health and safety plan mainly describes what kind of hazards are involved in the project, how they can be overcome and what sort of equipment will be used to overcome the problem. Health and safety plans will differ from job to job, but the underlying theme of every plan is that it should not only take care of the health and safety of the employees, but also ensure safety for visitors of the premises and the passersby¹.


¹ SOURCE: www.safeopedia.com

STATEMENT OF INDEPENDENCE

Ellis is a privately-held company and is not affiliated with any financial institution or other corporate entity. Ellis is retained as an independent contractor to provide objective, impartial investigation or analytical services regarding environmentally regulated hazardous or toxic materials. This report is not an endorsement or rejection of any specific methods used in handling or transport of potentially hazardous chemicals. Nor is intended as a complete hazardous materials survey of the entire building or facility. Ellis provides independent testing for asbestos, lead, indoor air contaminants and other potentially hazardous materials. The company and its employees are certified and licensed to practice in the State of California. Retained laboratories are accredited by the EPA, AREAL, NIOSH, AIHA, and CARB.

SIGNATORY

Respectfully,
ELLIS ENVIRONMENTAL MANAGEMENT, INC.

A handwritten signature in black ink, appearing to read "D. Behrens", with a long, wavy underline.

Duane E. Behrens, President
CAL/OSHA CAC Cert. #92-0226
CDPH Lead Inspector/Assessor #7914

proj # 17-312

<u>REF.</u>	<u>MATERIAL</u>	<u>MATERIAL LOCATION</u>	<u>FRIABLE</u>	<u>DAMAGE</u>	<u>% ASB</u>	<u>QTY*</u>	<u>UNIT</u>
<u>IDENTIFIED ASBESTOS MATERIALS</u>							
81707A	12" grey & green floor tile & mastic	kitchen	no	none	2-7%	450	s.f.
-	felt paper underneath wood flooring	auditorium	yes	none	assumed	1,800	s.f.
Patriot Env. In 2015	transite pipes	attic	no	none	5-15%	40	l.f.
Patriot Env. In 2015	roof penetration mastics and sealants	lower and main roof penetrations	no	none	6%	250	s.f.
<u>NON-ASBESTOS MATERIALS</u>							
81701A	exterior stucco	exterior			ND		
81702A	exterior concrete patch	exterior	-		ND		
81703A	brown cove base & mastic	kitchen	-		ND		
81704A, 81709A, 81711A	wall & ceiling plaster	throughout			ND		
81705A	12" light brown floor tile & mastic	kitchen			ND		
81706A	2x4' ceiling tile	kitchen			ND		
81708A	grey cove base & mastic	storage 1			ND		
81710A	wall board & joint compound	storage 1			ND		
Envirocheck 2008	concrete patch	exterior front wall			ND		
Envirocheck 2008	window putty	exterior kitchen			ND		
Envirocheck 2008	rolled roofing material	exterior rear storage			ND		
Envirocheck 2008	plaster	kitchen			ND		
Envirocheck 2008	yellow adhesive	storage 1 wall			ND		
Patriot 2015	grey covebase	storage 1			ND		
Patriot 2015	wallboard, plaster & joint compound	throughout			ND		
Patriot 2015	roof core	main & lower roof			ND		

Table 1
Bulk Sampling Results Summary
Clark Building
861 Valley Drive
Hermosa Beach, CA 90254



<u>REF.</u>	<u>MATERIAL</u>	<u>MATERIAL LOCATION</u>	<u>FRIABLE</u>	<u>DAMAGE</u>	<u>% ASB</u>	<u>QTY*</u>	<u>UNIT</u>
<u>IDENTIFIED LEAD-BASED PAINT</u>							
81703L	green door paint	womens restroom	0.22				
81706L	grey wall paint	kitchen	0.16				
81707L	green paint on plaster baseboard	auditorium	0.081				
81708L	yellow ceiling paint	kitchen	0.37				
81709L	grey cabinet paint	kitchen	0.34				
81712L	green wall paint	storage 2	0.13				
81713L	beige paint on closet	mens restroom	0.29				
<u>IDENTIFIED LEAD-CONTAINING PAINT</u>							
81704L	white wall paint on plaster	auditorium	0.041				
<u>IDENTIFIED NON-LEAD-CONTAINING PAINT</u>							
81701L	green door frame paint	auditorium	<0.01				
81702L	green door frame paint	auditorium	<0.01				
81705L	white door frame paint	auditorium	<0.01				
81710L	grey wall paint	womens restroom	<0.01				
81711L	grey wall paint	mens restroom	<0.01				
81714L	green wall paint	exterior stucco	<0.01				
81715L	white paint	exterior columns	<0.01				

Table 1
Bulk Sampling Results Summary
Clark Building
861 Valley Drive
Hermosa Beach, CA 90254

NOTES: Substrate: C=concrete, CB=concrete block, CE=ceramic tile, CT=ceiling tile, D=drywall, M=metal, P=plaster, S=stucco, W=wood; Condition: I=Intact, D=Damaged; Results: N=negative, P=positive, I=inconclusive							
Area	Component	Location (A, B, C, D)	Substrate	Condition (I or D)	Color	Pb (mg/cm ²)	Results (N, P, I)
auditorium	wall	a	c	i	w	0.1	
auditorium	column	a	c	i	grn	0.1	
auditorium	baseboard	a	p	i	grn	0.2	
auditorium	door trim	a	w	i	w	0.1	
auditorium	door	a	w	i	w	0.1	
auditorium	wall	b	p	i	w	0.2	
auditorium	door frame	b	w	i	grn	0.4	
auditorium	door	b	w	i	grn	0.2	
auditorium	baseboard	b	p	i	grn	0.3	
auditorium	wall	c	c	i	w	0.1	
auditorium	column	c	c	i	grn	0.1	
auditorium	wall	d	c	i	grn	0.2	
auditorium	column	d	c	i	grn	0.1	
auditorium	baseboard	d	p	i	grn	0.3	
auditorium	door frame	d	w	i	w	0.1	
auditorium	door casing	d	w	i	w	0.1	
kitchen	wall	a	d	i	w	-0.1	
kitchen	door casing	a	w	i	w	-0.1	
kitchen	door frame	a	w	i	w	0.1	
kitchen	door	a	w	i	w	0.1	
kitchen	cabinets	b	w	i	grey	0.2	
kitchen	wall	b	p	i	w	0.2	

The L.A. County DHS action level for lead-based paint is 0.7 mg/cm²
Negative readings are below LOD for XRF

Table 2
XRF Report Form
861 Valley Drive Hermosa Beach, CA 90254

NOTES: Substrate: C=concrete, CB=concrete block, CE=ceramic tile, CT=ceiling tile, D=drywall, M=metal, P=plaster, S=stucco, W=wood; Condition: I=Intact, D=Damaged; Results: N=negative, P=positive, I=inconclusive							
Area	Component	Location (A, B, C, D)	Substrate	Condition (I or D)	Color	Pb (mg/cm2)	Results (N, P, I)
kitchen	wall	c	p	i	grey	0.6	p
kitchen	ceiling	-	p	i	yellow	0.1	
kitchen	ceiling	-	p	i	grey	0.2	
womens restroom	floor	-	c	d	grey	0.2	
womens restroom	wall	b	p	i	w	0.3	
womens restroom	door	c	w	i	w	0.2	
attic access	wall	b	p	i	w	0	
attic access	floor	-	c	d	grey	0.1	
attic access	ladder	b	w	d	grey	0.1	
mens restroom ceramic tile	wall/janitors closet	a,d,b	ce	i	yellow	17.5	p
mens restroom	wall	b	c	d	grn	0.1	
mens restroom	window frame/casing	b	w	b	grn	0	
mens restroom	urinal	c	ce	i	w	0.4	
mens restroom	baseboard	c	w	i	grey	0	
storage 1	wall	b	c	i	grey	0.2	
storage 2	window frame	b	w	i	w	0.1	
storage 3	wall	c	d	i	grey	0.2	
mens restroom	door	c	w	d	grey	0.2	
storage 2	door frame	d	w	d	bge	1.8	p
storage 3	wall	c	d	i	w	0.1	
storage 4	ceiling	-	p	i	grn	0.2	
storage 5	door	d	w	i	grey	0	
exterior	wall	a	c	i	lt. grn	0.1	

The L.A. County DHS action level for lead-based paint is 0.7 mg/cm2
 Negative readings are below LOD for XRF

Table 2
 XRF Report Form
 861 Valley Drive Hermosa Beach, CA 90254



NOTES: Substrate: C=concrete, CB=concrete block, CE=ceramic tile, CT=ceiling tile, D=drywall, M=metal, P=plaster, S=stucco, W=wood; Condition: I=Intact, D=Damaged; Results: N=negative, P=positive, I=inconclusive							
Area	Component	Location (A, B, C, D)	Substrate	Condition (I or D)	Color	Pb (mg/cm ²)	Results (N, P, I)
exterior	door	a	w	i	dk. Grn	0.1	
exterior	column	a	c	i	w	0.2	
exterior	kitchen door	a	w	i	w	0	
exterior	wall	d	c	i	lt. grn	0.1	
exterior	hand rail	d	m	i	blk	0.2	
exterior	gutter	d	m	i	grn	0.1	

The L.A. County DHS action level for lead-based paint is 0.7 mg/cm²
 Negative readings are below LOD for XRF

Table 2
 XRF Report Form
 861 Valley Drive Hermosa Beach, CA 90254



Appendix A
Material and Sample Locations

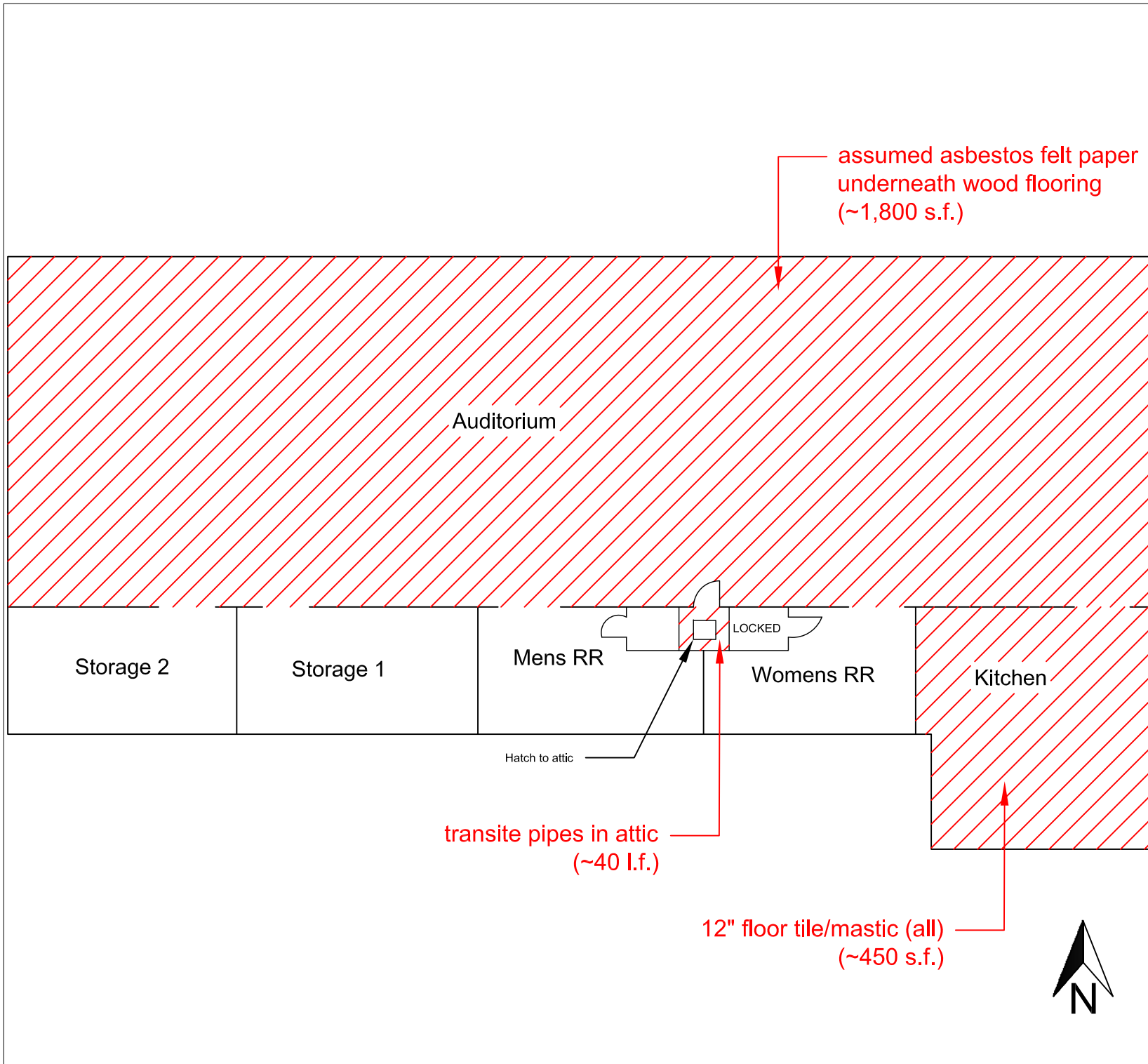


Fig. 1A: Asbestos Materials Location
 Clark Building - Interior
 861 Valley Dr., Hermosa Beach, CA

Firm Name and Address
 Ellis Environmental Mgmt, Inc.
 430 Silver Spur Rd., Suite 201
 Rancho Palos Verdes, CA 90275

Client Name and Address
 City of Hermosa Beach
 Clark Building
 861 Valley Dr.
 Hermosa Beach, CA

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Ellis		

Asbestos present only in roof
penetration mastics & sealants.
(~ 250 s.f.)



Fig. 1B: Asbestos Materials Location
Clark Building - Roof
861 Valley Dr., Hermosa Beach, CA

Firm Name and Address

Ellis Environmental Mgmt, Inc.
430 Silver Spur Rd., Suite 201
Rancho Palos Verdes, CA 90275

Client Name and Address

City of Hermosa Beach
Clark Building
861 Valley Dr.
Hermosa Beach, CA

Project #
17-312

Date:
8/23/2017

Sheet

1 of 1

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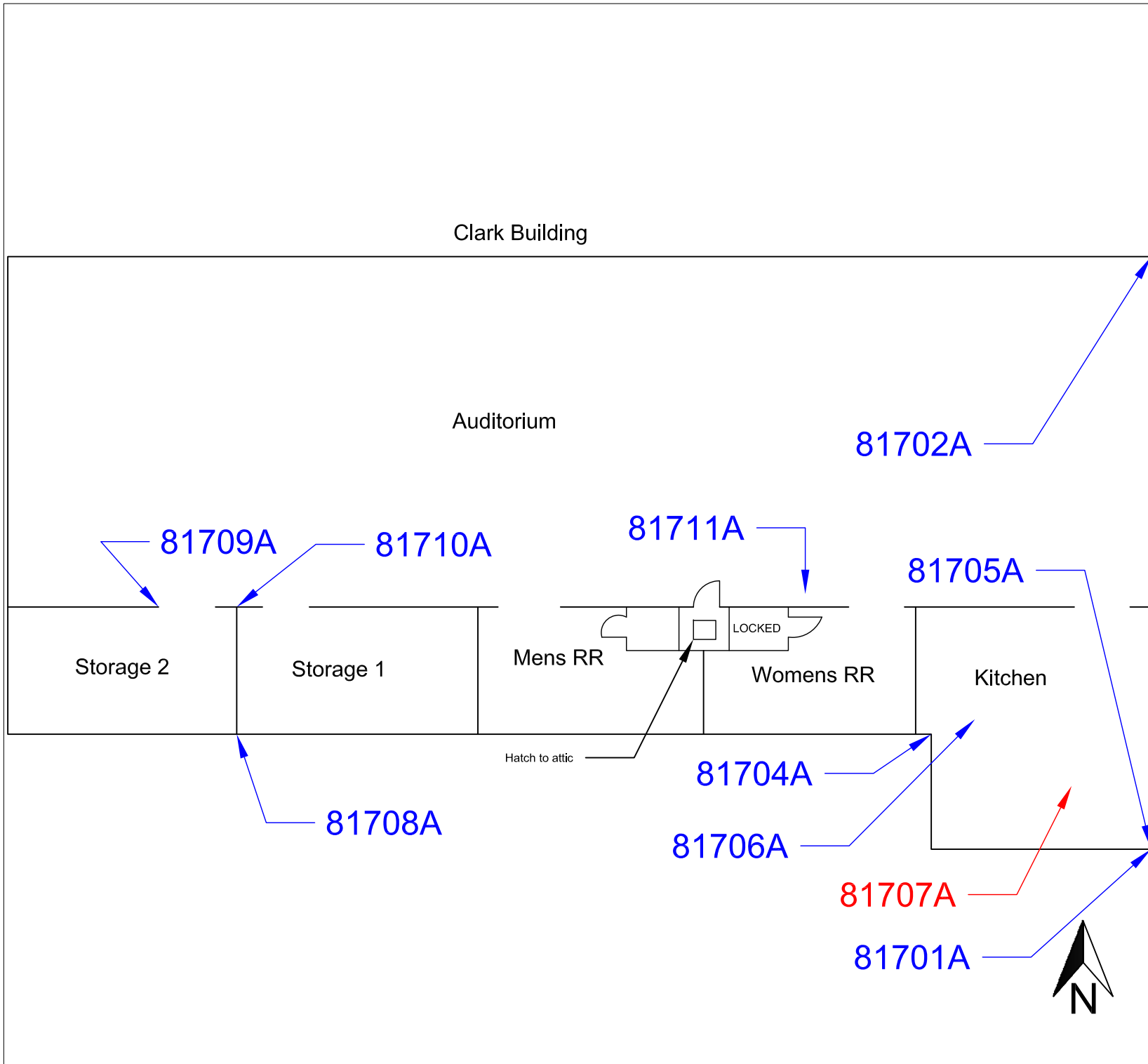


Fig. 2: Asbestos Sample Locations
 Clark Building
 861 Valley Dr., Hermosa Beach, CA

Firm Name and Address
 Ellis Environmental Mgmt, Inc.
 430 Silver Spur Rd., Suite 201
 Rancho Palos Verdes, CA 90275

Client Name and Address
 City of Hermosa Beach
 Clark Building
 861 Valley Dr.
 Hermosa Beach, CA

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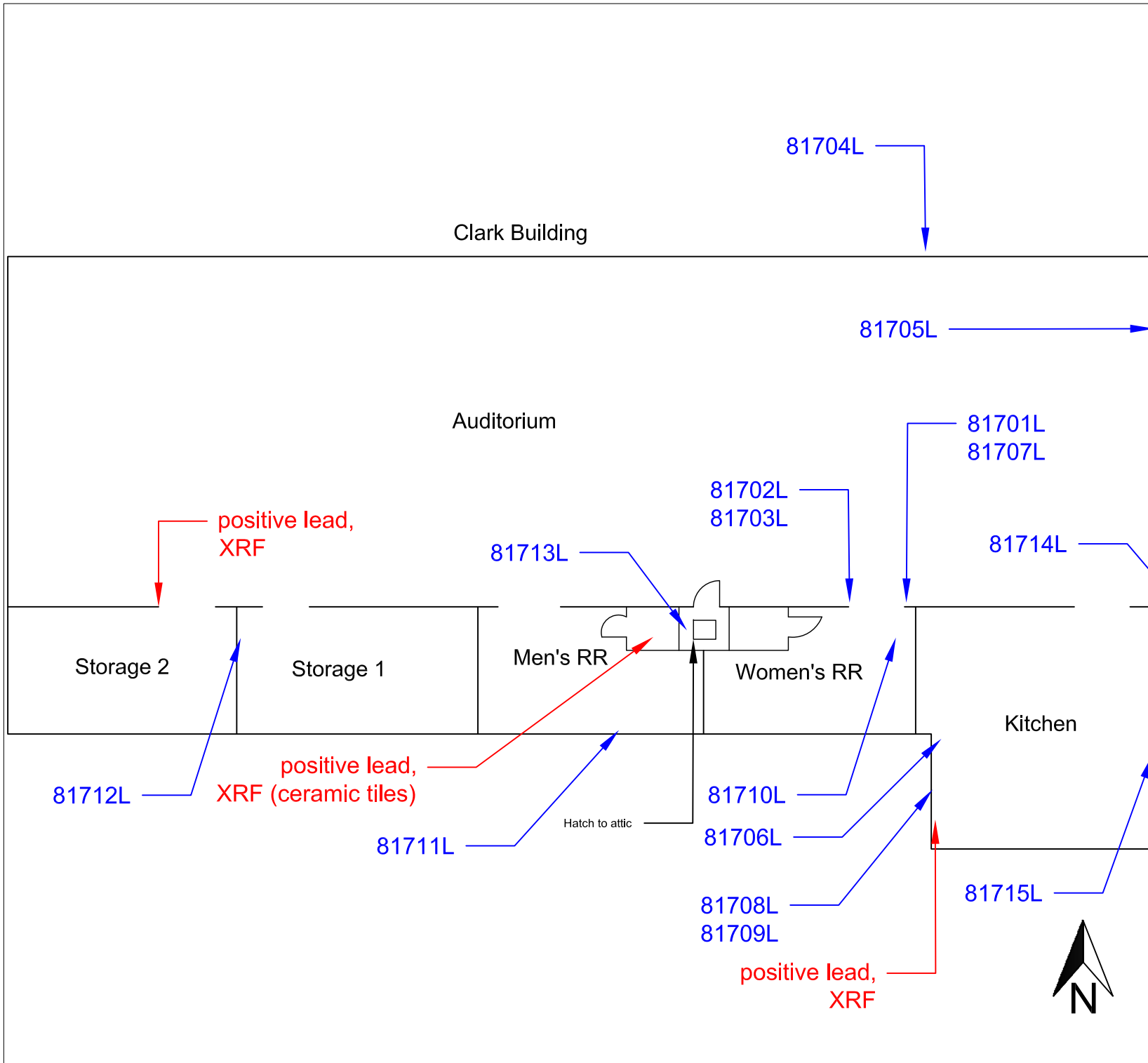


Fig. 3: Lead Sample Locations
 Clark Building
 861 Valley Dr., Hermosa Beach, CA

Firm Name and Address
 Ellis Environmental Mgmt, Inc.
 430 Silver Spur Rd., Suite 201
 Rancho Palos Verdes, CA 90275

Client Name and Address
 City of Hermosa Beach
 Clark Building
 861 Valley Dr.
 Hermosa Beach, CA

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Ellis		

Appendix B
Laboratory Results – Asbestos



AmeriSci Los Angeles

24416 S. Main Street, Ste 308
Carson, California 90745
TEL: (310) 834-4868 • FAX: (310) 834-4772

PLM Bulk Asbestos Report

Ellis Environmental Management, Inc.
Attn: Duane Behrens
430 Silver Spur Road
Suite 201
Rancho Palos Verdes, CA 90275

Date Received 08/17/17
Date Examined 08/22/17

AmeriSci Job # 917081650

P.O. #

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RE: 17-312; Hermosa Beach, City Of; Clark Bldg., 861 Valley Drive, HB, 90254

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
81701A Location: Exterior Stucco Analyst Description: White/Grey, Heterogeneous, Non-Fibrous, Cementitious, Stucco Asbestos Types: Other Material: Non-fibrous 100 %	917081650-01	No	NAD (by CVES) by Arturo A. Aldana on 08/22/17
81702A Location: Exterior Concrete Patch Analyst Description: Grey, Homogeneous, Non-Fibrous, Cementitious, Concrete Asbestos Types: Other Material: Non-fibrous 100 %	917081650-02	No	NAD (by CVES) by Arturo A. Aldana on 08/22/17
81703A Location: Brown Cove Base / Mastic - Kitchen Analyst Description: Dark Brown, Homogeneous, Non-Fibrous, Cove Base Asbestos Types: Other Material: Non-fibrous 100 %	917081650-03L1	No	NAD (by CVES) by Arturo A. Aldana on 08/22/17
81703A Location: Brown Cove Base / Mastic - Kitchen Analyst Description: Brown, Homogeneous, Non-Fibrous, Mastic Asbestos Types: Other Material: Non-fibrous 100 %	917081650-03L2	No	NAD (by CVES) by Arturo A. Aldana on 08/22/17
81704A Location: Wall / Ceiling Plaster - Kitchen Heater Closet Analyst Description: Light Grey, Heterogeneous, Non-Fibrous, Cementitious, Plaster Asbestos Types: Other Material: Non-fibrous 100 %	917081650-04	No	NAD (by CVES) by Arturo A. Aldana on 08/22/17

Client Name: Ellis Environmental Management, Inc.

PLM Bulk Asbestos Report17-312; Hermosa Beach, City Of; Clark Bldg., 861 Valley
Drive, HB, 90254

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
81705A Location: 12" Lt. Brown FT/Mastic - Kitchen	917081650-05L1	No	NAD (by CVES) by Arturo A. Aldana on 08/22/17
Analyst Description: Tan, Homogeneous, Non-Fibrous, Floor Tile			
Asbestos Types:			
Other Material: Non-fibrous 100 %			
81705A Location: 12" Lt. Brown FT/Mastic - Kitchen	917081650-05L2	No	NAD (by CVES) by Arturo A. Aldana on 08/22/17
Analyst Description: Off-White, Homogeneous, Non-Fibrous, Mastic			
Asbestos Types:			
Other Material: Non-fibrous 100 %			
81706A Location: 2'x4' CT - Kitchen	917081650-06	No	NAD (by CVES) by Arturo A. Aldana on 08/22/17
Analyst Description: White/Beige, Homogeneous, Fibrous, Ceiling Tile			
Asbestos Types:			
Other Material: Cellulose 15 %, Non-fibrous 85 %			
81707A Location: 12" Grey FT/Mastic - Kitchen	917081650-07L1	Yes	2 % (by CVES) by Arturo A. Aldana on 08/22/17
Analyst Description: Grey, Homogeneous, Non-Fibrous, Floor Tile			
Asbestos Types: Chrysotile 2.0 %			
Other Material: Non-fibrous 98 %			
81707A Location: 12" Grey FT/Mastic - Kitchen	917081650-07L2	No	NAD (by CVES) by Arturo A. Aldana on 08/22/17
Analyst Description: Yellow, Homogeneous, Non-Fibrous, Mastic			
Asbestos Types:			
Other Material: Non-fibrous 100 %			
81708A Location: Grey Cove Base / Mastic - Storage 1	917081650-08L1	No	NAD (by CVES) by Arturo A. Aldana on 08/22/17
Analyst Description: Grey, Homogeneous, Non-Fibrous, Cove Base			
Asbestos Types:			
Other Material: Non-fibrous 100 %			

Client Name: Ellis Environmental Management, Inc.

PLM Bulk Asbestos Report17-312; Hermosa Beach, City Of; Clark Bldg., 861 Valley
Drive, HB, 90254

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
81708A Location: Grey Cove Base / Mastic - Storage 1	917081650-08L2	No	NAD (by CVES) by Arturo A. Aldana on 08/22/17
Analyst Description: Off-White, Homogeneous, Non-Fibrous, Mastic Asbestos Types: Other Material: Non-fibrous 100 %			
81709A Location: Wall / Ceiling Plaster - Storage 2	917081650-09	No	NAD (by CVES) by Arturo A. Aldana on 08/22/17
Analyst Description: Off-White/Grey, Heterogeneous, Non-Fibrous, Cementitious, Plaster Asbestos Types: Other Material: Non-fibrous 100 %			
81710A Location: WB/JC - Storage 1	917081650-10.1	No	NAD (by CVES) by Arturo A. Aldana on 08/22/17
Analyst Description: White, Homogeneous, Non-Fibrous, Joint Compound Asbestos Types: Other Material: Non-fibrous 100 %			
81710A Location: WB/JC - Storage 1	917081650-10.2	No	NAD (by CVES) by Arturo A. Aldana on 08/22/17
Analyst Description: White/Brown, Homogeneous, Fibrous, Wallboard Asbestos Types: Other Material: Cellulose 5 %, Non-fibrous 95 %			
81711A Location: Ceiling Plaster - Auditorium	917081650-11	No	NAD (by CVES) by Arturo A. Aldana on 08/22/17
Analyst Description: Beige, Heterogeneous, Non-Fibrous, Cementitious, Plaster Asbestos Types: Other Material: Non-fibrous 100 %			

Client Name: Ellis Environmental Management, Inc.

PLM Bulk Asbestos Report

17-312; Hermosa Beach, City Of; Clark Bldg., 861 Valley Drive, HB, 90254

Reporting Notes:

Analyzed By: Arturo A. Aldana at alda; Date Analyzed: 8/22/2017 8/22/17

*NAD = no asbestos detected; Detection Limit <1%; Reporting Limits: CVES = 1%, 400 Pt Ct = 0.25%, 1000 Pt Ct = 0.1%; NA = not analyzed; NA/PS = not analyzed / positive stop; NVA = No Visible Asbestos; PLM (polarized light microscopy) Bulk Asbestos Analysis by EPA 600/R-93/116, including requirements for EPA 600/M4-82-020 per 40 CFR 763 (NVLAP Lab #200346-0, CA ELAP lab #2322); Note: PLM is not consistently reliable in detecting asbestos in floor coverings and similar NOB materials. TEM is currently the only method that can be used to determine if this material can be considered or treated as non-asbestos-containing in New York State (also see EPA Advisory for floor tile, FR 59, 146, 38970, 8/1/94). NIST Accreditation requirements mandate that this report must not be reproduced except in full with the approval of the laboratory. This PLM report relates ONLY to the items tested.

Reviewed By: at alda

Ellis Environmental Management, Inc.

430 Silver Spur Road, Suite 201
 Rancho Palos Verdes, CA 90275
 (310) 544-1837 (tel)
 (310) 544-2167 (fax)

Project No.: 17-312

Client: HERMOSEA BEACH, CITY OF

Location: CLARK BLDG.

861 VALLEY DRIVE, HB, 90254

Sampler: DB/SB/LS

Sheet 1 of 4


CHAIN OF CUSTODY RECORD

Q17081650

Sample Number	Description	Date	Time	H2O	Air	Solid	Tests Required
81701A	EXTERIOR STUCCO	8/17/17	AM			X	PLM ASBESTOS
81702A	EXTERIOR CONCRETE PATCH						
81703A	BROWN CORE BASE/MASTIC - KITCHEN						
81704A	WALL/CEILING PLASTER - KITCHEN HEATER CLOSET						
81705A	12" LT. BROWN FT/MASTIC - KITCHEN						
81706A	2' x 4' CT - KITCHEN						
81707A	12" GREY FT/MASTIC - KITCHEN						
81708A	GREY CORE BASE/MASTIC - STORAGE						
81709A	WALL/CEILING PLASTER - STORAGE						
81710A	WB/JC - STORAGE						
81711A	CEILING PLASTER - AUDITORIUM						

Turnaround: same day 24 hrs. 48 hrs. 3 days 5 days (Standard)

Special Instructions:

Date	Relinquished By	Received By	Date
8/17/17		Pissaman Jones	8/17/17 016.00

Appendix C
Laboratory Results - Lead



AmeriSci Los Angeles

24416 S. Main Street, Ste 308
Carson, California 90745
TEL: (310) 834-4868 • FAX: (310) 834-4772

AmeriSci Job #: 417081267

Date Received: 08/17/17

Date Analyzed: 08/21/17

Lead Analysis Results

Paint

EPA Method 3050B/7000B

Ellis Environmental Management, Inc.

Rancho Palos Verdes, CA

Job Site: 17-312; Hermosa Beach, City Of; Clark Bldg., 861 Valley Dr. HB, 90254

AmeriSci #	Client Number	Sample Location	% Lead (w/w)	Lead Content (mg/kg = ppm)
417081267				
01	81701L	Green Column Paint	<0.01	<100
02	81702L	Green Door Frame Paint	<0.01	<100
03	81703L	Green Door Paint	0.22	2,200
04	81704L	White Wall Paint On Plaster	0.041	410
05	81705L	White Door Frame Paint On Wood	<0.01	<100
06	81706L	Grey Wall Paint - Kitchen	0.16	1,600
07	81707L	Green Paint On Plaster Baseboard	0.081	810
08	81708L	Yellow Ceiling Paint - Kitchen	0.37	3,700
09	81709L	Grey Cabinet Paint	0.34	3,400
10	81710L	Grey Paint - Walls, Women's RR	<0.01	<100
11	81711L	Grey Paint - Wall, Men's RR	<0.01	<100
12	81712L	Green Wall Paint - Storage 2	0.13	1,300
13	81713L	Beige Paint - Men's Closet RR Door	0.29	2,900
14	81714L	Green Wall Paint - Ext. Stucco	<0.01	<100
15	81715L	White Paint - Ext. Column	<0.01	<100

AmeriSci Reporting Limit is 0.01%, or 100mg/kg prior to any dilutions due to high analyte concentrations or matrix interferences. AmeriSci does not correct sample results by the blank value. All analytical batch data met quality control criteria unless otherwise noted. CA ELAP No. 2322.

Reviewed by: _____

Analyzed by: 
Soheir Galess, Chemist

EMM Environmental Management, Inc.

430 Silver Spur Road, Suite 201
 Rancho Palos Verdes, CA 90275
 (310) 544-1837 (tel)
 (310) 544-2167 (fax)

Project No.: 17-312
 Client: HERMOSA BEACH, CITY OF
 Location: CLARK BLDG.
861 VALLEY DR, HB, 90254

Sampler: DB/SB/LS

CHAIN OF CUSTODY RECORD


Sheet 2 of 4

417081267

Sample Number	Description	Date	Time	H2O	Air	Solid	Tests Required
81701L	GREEN COLUMN PAINT	8/17/17	AM			X	FLAME PMS LEAD
81702L	GREEN DOOR FRAME PAINT	↓	↓			↓	
81703L	GREEN DOOR PAINT						
81704L	WHITE WALL PAINT ON PLASTER						
81705L	WHITE DOOR FRAME PAINT ON WOOD						
81706L	GREY WALL PAINT - KITCHEN						
81707L	GREEN PAINT ON PLASTER BASEBOARD						
81708L	YELLOW CEILING PAINT - KITCHEN						
81709L	GREY CABINET PAINT						
81710L	GREY PAINT - WALLS, WOMEN'S RR						
81711L	GREY PAINT - WALL, MEN'S RR						
81712L	GREEN WALL PAINT - STORAGE 2						

Turnaround: same day 24 hrs. 48 hrs. 3 days 5 days (Standard)

Special Instructions:

Date	Relinquished By	Received By	Date
8/17/17		Pissaman Jony	8/17/17 @ 16.00

Ellis Environmental Management, Inc.

430 Silver Spur Road, Suite 201
 Rancho Palos Verdes, CA 90275
 (310) 544-1837 (tel)
 (310) 544-2167 (fax)

Project No.: 17-312

Client: _____

Location: _____

Sampler: DB/SB/LS

CHAIN OF CUSTODY RECORD


Sheet 3 of 4

417081267

Sample Number	Description	Date	Time	H2O	Air	Solid	Tests Required
81713L	BEIGE PAINT - MEN'S RR CLOSET DOOR	8/17/17	AM			X	FLAME ATAS LEAD
81714L	GREEN WALL PAINT - EXT. STUCCO	↓	↓			↓	↓
81715L	WHITE PAINT - EXT. COLUMN	↓	↓			↓	↓

Turnaround: ___ same day ___ 24 hrs. ___ 48 hrs. 3 days ___ 5 days (Standard)

Special Instructions: _____

Date	Relinquished By	Received By	Date
8/17/17		Pissaman Jome	8/17/17 @ 16:00

Appendix D
Ellis / Lab Certifications

Certificate Of Completion

Asbestos Building Inspector Refresher Course

DOSH #:CA-015-06

Duane Behrens

ABIR0307170003N12298

Alan Dages

Principal Instructor



Michael W. Horner
Training Director

3/7/2017

Course Start Date

3/7/2017

Course End Date

3/7/2017

Exam Date

3/7/2018

Expiration Date

This course satisfies the education requirements for Asbestos accreditation under the Toxic Substances Control Act, Title II. This course has been approved by the Department of Industrial Relations, Division of Occupational Safety and Health of the State of California

NATEC International, Inc.

National Association of Training and Environmental Consulting

1100 Technology Circle- Suite A, Anaheim, CA 92805 • www.natecintl.com • 800-969-3228



Certificate Of Completion

Asbestos Contractor/Supervisor Refresher Course

DOSH #:CA-015-04

Duane Behrens

Last 4 digits of SSN: 1472

ASR0317170003N12363

Sam Madera

Principal Instructor



Michael W. Horner
Training Director

3/17/2017
Course Start Date

3/17/2017
Course End Date

3/17/2017
Exam Date

3/17/2018
Expiration Date

This course satisfies the education requirements for Asbestos accreditation under the Toxic Substances Control Act, Title II. This course has been approved by the Department of Industrial Relations, Division of Occupational Safety and Health of the State of California

NATEC International, Inc.

National Association of Training and Environmental Consulting

1100 Technology Circle- Suite A, Anaheim, CA 92805 • www.natecintl.com • 800-969-3228



Certificate Of Completion

Asbestos Management Planner Refresher Course

DOSH #:CA-015-08

Duane Behrens

AMPR0307170002N12402

Alan Dages

Principal Instructor



Michael W. Horner

Training Director

3/7/2017

Course Start Date

3/7/2017

Course End Date

3/7/2017

Exam Date

3/7/2018

Expiration Date

This course satisfies the education requirements for Asbestos accreditation under the Toxic Substances Control Act, Title II. This course has been approved by the Department of Industrial Relations, Division of Occupational Safety and Health of the State of California

NATEC International, Inc.

National Association of Training and Environmental Consulting

1100 Technology Circle- Suite A, Anaheim, CA 92805 • www.natecintl.com • 800-969-3228



Certificate Of Completion

Asbestos Project Designer Refresher Course

DOSH #:CA-015-10

Duane Behrens

APDR0118170005N12462

Alan Dages

Principal Instructor



Michael W. Horner

Training Director

1/18/2017

Course Start Date

1/18/2017

Course End Date

1/18/2017

Exam Date

1/18/2018

Expiration Date

This course satisfies the education requirements for Asbestos accreditation under the Toxic Substances Control Act, Title II. This course has been approved by the Department of Industrial Relations, Division of Occupational Safety and Health of the State of California

NATEC International, Inc.

National Association of Training and Environmental Consulting

1100 Technology Circle- Suite A, Anaheim, CA 92805 • www.natecintl.com • 800-969-3228



State of California
Division of Occupational Safety and Health
Certified Asbestos Consultant

Duane E Behrens

Name

Certification No. **92-0226**

Expires on **07/10/18**



This certification was issued by the Division of Occupational Safety and Health as authorized by Sections 7180 et seq. of the Business and Professions Code.

State of California Department of Public Health

Lead-Related
Construction
Certificate

Certificate
Type

Expiration
Date

Inspector/Assessor

04/12/2018



Duane E. Behrens

ID #: 7914

University of Southern California

INSTITUTE OF
SAFETY AND SYSTEMS MANAGEMENT
A NIOSH EDUCATION RESOURCE CENTER

This is to certify that

DUANE E. BEHRENS

has satisfactorily completed a course in

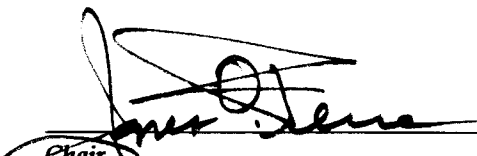
Sampling and Evaluating Airborne Asbestos Dust

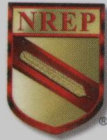
on this day of

MARCH 11, 1988




Executive Director,
Institute of Safety and Systems Management


Chair
Safety Science Department



**National Registry of
Environmental Professionals®**
CERTIFIED

Duane Behrens REPA 621880
Registered Environmental Property Assessor

The Person Named Above is
Qualified as Defined by the NREP

03/15/2018

Richard A. Young
Executive Director

First Certified: 03/15/2013

Expiration Date

Certificate Of Completion

Asbestos Contractor/Supervisor Refresher Course

DOSH #:CA-015-04

Lina Sok

ASR0927160005N10550

Guillermo Renteria

Principal Instructor



Michael W. Horner

Training Director

9/27/2016

Course Start Date

9/27/2016

Course End Date

9/27/2016

Exam Date

9/27/2017

Expiration Date

This course satisfies the education requirements for Asbestos accreditation under the Toxic Substances Control Act, Title II. This course has been approved by the Department of Industrial Relations, Division of Occupational Safety and Health of the State of California

NATEC International, Inc.

National Association of Training and Environmental Consulting

1100 Technology Circle- Suite A, Anaheim, CA 92805 • www.natecintl.com • 800-969-3228



State of California
Division of Occupational Safety and Health
Certified Site Surveillance Technician



Lina Sok

Name

Certification No. 15-5499

Expires on 11/17/17

This certification was issued by the Division of Occupational Safety and Health as authorized by Sections 7180 et seq. of the Business and Professions Code.

130685

**CDPH COURSE COMPLETION FORM
AND TRAINING CERTIFICATE**

Form Number

Instructions: The top half of this form is to be completed by the student, and the bottom half is to be completed by the accredited training provider. The accredited training provider must submit the top (white) copy of this form to CLPPB **and** the last two (pink and yellow) copies to the student within **30 calendar days** of the student's successful completion of the final examination. / **Instrucciones:** La parte superior de este formulario deberá ser completada por el estudiante y la parte inferior por el Proveedor acreditado del entrenamiento. El Proveedor del entrenamiento tiene que mandar la copia blanca a CLPPB y las copias rosada y amarilla al estudiante dentro de los siguientes 30 días después de haber pasado el examen final.

Student Information – To be completed by the student. Please print or type. Press firmly. / Deberá completarse por el estudiante. Favor de escribir firmemente y con letra de molde.

Name / Nombre (last / apellido paterno) **SOX** (first / primer nombre) **LINA** (middle initial / segundo nombre) Telephone number / Número de teléfono **(562) 481-5336**

Home address (number, street, apartment number, PO box number / Dirección (número, calle, número de apartamento, apartado postal) **1755 FREEMAN AVE. APT 1A, LONG BEACH, CA 90804** Date of birth (month/day/year) / Fecha de nacimiento (mes/día/año) **11 / 20 / 1989**

City / Ciudad **LONG BEACH** State / Estado **CA** ZIP code / Código postal **90804** Photo identification / Tarjeta de identificación con foto Number / Número **D8051753** Type / Tipo Driver's license / Licencia de conducir Resident alien card / Tarjeta de residencia Other ID / Otro tipo de ID (specify / especifique):

Mailing address, if different (employer or union name, number, street, apartment number, PO box number) / Dirección de correo, si es diferente (nombre de patron or unión, número, calle, número de apartamento, apartado postal)

Gender / Sexo Male / Masculino Female / Femenino


If currently CDPH certified, provide CDPH certificate ID number / Si está certificado por CDPH, favor de dar su número de CDPH

City / Ciudad State / Estado ZIP code / Código postal

Race/Ethnicity / Raza/Etnia

Asian / Asiático Black/African American / Negro/Africano Americano Latino/Hispanic / Latino/Hispano Native American / Americano Nativo White / Caucásico Pacific Islander / Pacífico Isleño Other / Otro:

Prior to signing, read the Privacy Statement and other information on the back of the form. / Antes de firmar, lea la Declaración Sobre la Privacidad, y otra información en la parte de atrás de este formulario.

Signature of student / Firma del estudiante  Date (month/day/year) / Fecha (mes/día/año) **9 / 4 / 15**

Training Information – To be completed by accredited training provider. Please print or type. Press firmly.

Accredited Training Provider name and address **NATEC International Inc** Training Provider Phone Number **714.478.2750**

1100 Technology Circle Anaheim CA 92805 Course Number **005-1/A**

Course title: Work Continuing Education for Workers Inspection/Assessment General Continuing Education Certified Industrial Hygienist Supervision and Project Monitoring Sampling Technician Supplemental Supervision and Project Monitoring English Spanish

Course dates (mm/dd/yy) **8 / 31 / 15 to 9 / 4 / 15** Number of contact hours of instruction completed **40** Date student passed course or continuing education final examination (mm/dd/yy) **9 / 4 / 15** Core instruction (if different) Core instruction CCF number

Location of course **1100 Technology Circle Anaheim CA 92805** Core CCF date (mm/dd/yy)

As Training Director, I hereby certify, under penalty of perjury, that the information provided herein is true and correct.

Name of Training Director – please print or type **Michael W. Horner** Signature of Training Director  Date (mm/dd/yy) **9 / 9 / 15**

White copy – CLPPB

Blue copy – Training Provider

PINK copy – Student (for Certification Application)

Yellow copy – Student



Certificate of Attendance

CERTIFICATE NUMBER

96365

This is to Certify that

LINA SOK

Has Completed the Course of

AIR SAMPLING & ANALYSIS OF AIRBORNE ASBESTOS (NIOSH-582 EQUIVALENT)

FOR PURPOSES OF ACCREDITATION IN ACCORDANCE WITH 29 CFR 1926.503
AND CCR, TITLE 8, ARTICLE 2.7, 341.16 AND SECTION 206 OF TITLE II OF THE TOXIC SUBSTANCE CONTROL ACT (TSCA)

ARMANDO DUCOING
DIRECTOR

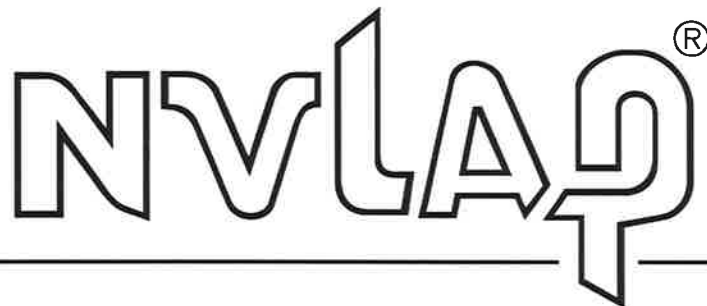
February 27, 2015
COMPLETION DATE

E022315NIOSH 022315
CLASS NUMBER / STARTING DATE

CERTIFICATE EXPIRES

Ecologics Training Institute

United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 200346-0

AmeriSci Los Angeles
Carson, CA

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services,
listed on the Scope of Accreditation, for:*


Asbestos Fiber Analysis

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality
management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).*

2017-01-01 through 2017-12-31

Effective Dates




For the National Voluntary Laboratory Accreditation Program



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

AmeriSci Los Angeles
DBA: AmeriSci Los Angeles
24416 South Main Street, Suite 308
Carson, CA 90745
Mr. Glenn F. Massey
Phone: 310-834-4868 Fax: 310-834-4772
Email: gmassey@amerisci.com
<http://www.amerisci.com>

ASBESTOS FIBER ANALYSIS

NVLAP LAB CODE 200346-0

Bulk Asbestos Analysis

<u>Code</u>	<u>Description</u>
18/A01	EPA 600/M4-82-020: Interim Method for the Determination of Asbestos in Bulk Insulation Samples
18/A03	EPA 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials

Airborne Asbestos Analysis

<u>Code</u>	<u>Description</u>
18/A02	U.S. EPA's "Interim Transmission Electron Microscopy Analytical Methods-Mandatory and Nonmandatory-and Mandatory Section to Determine Completion of Response Actions" as found in 40 CFR, Part 763, Subpart E, Appendix A.

A handwritten signature in cursive script, appearing to read "Tara S. Laman".

For the National Voluntary Laboratory Accreditation Program

Appendix E

**Lead “Trigger Tasks”
CDPH Form 8552**

LEAD - "TRIGGER TASKS"

(SOURCE: California Title 8 Section 1532.1.)

Following testing, Construction Managers and Superintendents may use the following to decide whether (and for how long) an abatement contractor should be retained during disturbance of painted surfaces.

Paint Categories

1. Lead-Based. >.06% Lead by Weight. Start-to-finish, retain an abatement contractor to perform trigger tasks listed below.
2. Lead-Containing. 0.009 – 0.06% lead by weight. Retain an abatement contractor to perform only an initial "Negative Exposure Assessment" for the trigger tasks listed below. Low results- no further precautions required.
3. Non-Lead-Containing <.009% lead by weight. No special lead-related precautions required.

Lowest Exposure Trigger Tasks:

Unless proven otherwise (NEA), assume exposures greater than 50 and up to 500 µg/m³ where lead-based coatings or paint are present:

- manual demolition of structures
- manual scraping
- manual sanding
- heat gun applications
- power tool cleaning with dust collection system
- spray painting with lead
- any other task where employees may be exposed over the PEL.

Medium Exposure Trigger Tasks:

Unless proven otherwise (NEA), assume exposures greater than 500 and up to 2,500 µg/m³ where lead-based coatings or paint are present:

- use of lead-containing mortar
- lead burning
- rivet busting
- power tool cleaning without dust collection systems
- cleanup of dry expendable abrasives
- abrasive blasting enclosure movement and removal

Highest Exposure Trigger Tasks:

Assume exposures greater than 2,500 µg/m³ unless proven otherwise where lead-based coatings or paint are present:

- abrasive blasting
- welding
- cutting
- torch burning

LEAD HAZARD EVALUATION REPORT

Section 1 – Date of Lead Hazard Evaluation 8/19/17 Proj #17-312

Section 2 – Type of Lead Hazard Evaluation (Check one box only)

Lead Inspection
 Risk assessment
 Clearance Inspection
 Other (specify) Pre-Renovation Sampling

Section 3 – Structure Where Lead Hazard Evaluation Was Conducted

Address [number, street, apartment (if applicable)]		City	County	Zip Code
861 Valley Drive - The Clark Building		Hermosa Beach	Los Angeles	90254
Construction date (year) of structure	Type of structure		Children living in structure?	
1936	<input type="checkbox"/> Multi-unit building <input type="checkbox"/> School or daycare <input type="checkbox"/> Single family dwelling <input checked="" type="checkbox"/> Other <u>auditorium</u>		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Don't Know	

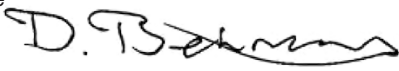
Section 4 – Owner of Structure (if business/agency, list contact person)

Name		Telephone number	
City of Hermosa Beach		310 318 0235	
Address [number, street, apartment (if applicable)]		City	State
1315 Valley Drive		Hermosa Beach	CA
		Zip Code	
			90254

Section 5 – Results of Lead Hazard Evaluation (check all that apply)

No lead-based paint detected
 Intact lead-based paint detected
 Deteriorated lead-based paint detected
 No lead hazards detected
 Lead-contaminated dust found
 Lead-contaminated soil found
 Other _____

Section 6 – Individual Conducting Lead Hazard Evaluation

Name		Telephone number	
Duane Behrens		310 544 1837	
Address [number, street, apartment (if applicable)]		City	State
430 Silver Spur Road		Rancho Palos Verdes	CA
		Zip Code	
			90275
CDPH certification number	Signature	Date	
7914		8/25/17	

Name and CDPH certification number of any other individuals conducting sampling or testing (if applicable)

Section 7 – Attachments

- A. A foundation diagram or sketch of the structure indicating the specific locations of each lead hazard or presence of lead-based paint;
- B. Each testing method, device, and sampling procedure used;
- C. All data collected, including quality control data, laboratory results, including laboratory name, address, and phone number.

First copy and attachments retained by inspector
 Second copy and attachments retained by owner

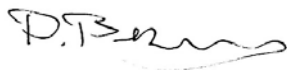
Third copy only (no attachments) mailed or faxed to:
 California Department of Public Health
 Childhood Lead Poisoning Prevention Branch Reports
 850 Marina Bay Parkway, Building P, Third Floor
 Richmond, CA 94804-6403
 Fax: (510) 620-5656

CLEARANCE – ASBESTOS & LEAD
Clark Building – Kitchen & Restroom
861 Valley Drive, Hermosa Beach, CA 90254

From October 23 to 25, 2017, Ellis conducted visual inspections, air monitoring and wipe sampling during and after: (a) flooring/mastic abatement in the kitchen, (b) removal of lead-based paint cabinets in the kitchen, (c) stabilization and encapsulation of lead-based paint in the kitchen, restrooms and storage rooms, and (d) removal of lead ceramic tile in the men’s restroom. Abatement and cleaning efforts, which included wet wiping and HEPA vacuuming of potential asbestos and lead debris, were performed by New Horizons Contracting, License #943743. The work was monitored by Ellis Environmental Management, Inc., an independent environmental testing/consulting firm located in Rancho Palos Verdes, California. Samples were analyzed at AmeriSci, an AIHA and NVLAP accredited laboratory located in Carson, CA. Analysis methods are included on the first page of each results sheet (attached).

Upon completion, airborne fiber levels in the work area were measured at less than 0.01 fibers per cubic centimeter air (f/cc), the EPA "Clearance Level" for an abatement work area.¹ This is consistent with normal outside air - less than one-tenth California OSHA’s “permissible exposure limit” of 0.1 f/cc². Wipe sampling performed following the work indicated surface concentrations of less than the CDPH “hazard level” of 40 ug/ft² in cleaned areas. All areas were cleared for re-occupancy by non-protected personnel on October 25th.

Signatory:
ELLIS ENVIRONMENTAL MANAGEMENT, INC.



Duane E. Behrens
President, Environmental Professional
CAC #92-0226
CDPH #7914

Project No.: 17-454
Date: November 3, 2017
Client: City of Hermosa Beach

Ellis Environmental Management, Inc. is a privately held company and is not affiliated with any financial institution or other corporate entity. Ellis is retained as an independent contractor to provide objective, impartial investigatory or analytical service regarding environmentally regulated hazardous or toxic materials. Ellis provides independent testing for indoor air contaminants and other potentially hazardous materials. The company and its employees are certified and licensed to practice in the State of California. Employees providing asbestos-related building inspections maintain current certification requirements as issued by California OSHA and the California Department of Health Services. Retained laboratories are accredited by the EPA (AREAL), NIOSH, DOHS, AIHA, DOHS, NVLAP and CARB.

¹ 40 CFR Part 763 – AHERA. Originally developed for schools, .01 f/cc has become the most widely used and accepted criterion for clearance following an asbestos removal action.

² See California Title 8 Section 1529, Asbestos.



Pre-abatement (kitchen)



Post-abatement (kitchen)



During cabinet removal and paint stabilization (kitchen)



Pre-abatement (men's restroom)

Project Log

Project Number: 17-454 Client: Hermosa Beach Date: 10-23-17

Project: Clark Bldg Time: Arr: 07:00

Weather: Temp: Conditions: Sunny / Indoors Dep: 15:15

Abatement Contractor: New Horizons Crew Comp: 1S, 5C

Job Scope: Abate LBP, ASB floor in kitchen, Abate/stabilize mold in Storage

Daily Job Descript: + Abate tile in mens RR.

Comments (Include: Engineering controls/work practices; significant events, contacts, visitors; Air sample location; Personal pump use):

(07:00) Ellis/NH/Liz (HB) on site. Worker certs/Notifications on site. NH sets up containment @ mens RR + Storage rms. Liz gives key to NH foreman. (08:00) HB Maintenance crew arrives to remove refrigerator, janitor supplies from kitchen. NH begins demo/removal of appliances in kitchen. HB maint turns off gas + water to bldg. (09:30) first containment passes pre-visual. Ellis starts lead air monitor # 1023 L1 (10:30) Waste profile # S-L1 taken from storage rm 2. (11:00-12:00) NH lunch. (12:00) NH begins set up of containment in kitchen. Waste profile # T-L2 taken from tile in mens RR. ~~10:00-5c~~ (13:00) Kitchen containment passes pre-visual. (14:30) Waste profile # K-L3 from kitchen collected.

SL

Ellis Environmental Management, Inc.
430 Silver Spur Road, #201
Rancho Palos Verdes, CA 90275
(310) 544 1837
(310) 544 2167 (fax)

Sheet 1 of 1

Project Log

Project Number: 17-454 Client: City of HB Date: 10-24-17
Project: Claik Bldg. Time: Arr: 07:00
Weather: Temp: _____ Conditions: Sunny/Indoor's Dep: 14:15
Abatement Contractor: New Horizons Crew Comp: 15, 5c
Job Scope: Abate ASB floors, water/dmg walls, Encap/Stub. USP
Daily Job Descript: _____

Comments (Include: Engineering controls/work practices; significant events, contacts, visitors; Air sample location; Personal pump use):

(07:00) Ellis/NH on site. NH foreman opens door with key. Ellis starts lead air monitor #1024L2. Crew begins work in kitchen, storage approx 90% complete, RR approx 50% complete. NH stores wrapped kitchen cabinets in women's RR. (11-12) NH lunch. Men's RR tile 90% done. (12:15) Kitchen containment passes visual for LRP + to start ASB floor removal, waste is dtd bagged + stored in Women's RR. (13:50) Men's RR shower tile passes post-visual insp.

Project Log

Project Number: 17-454 Client: CITY OF HERMOSA BEACH Date: 10/25/17
Project: CLARK BUILDING Time: Arr: 06:50
Weather: Temp: 78° Conditions: CLEAR Dep: _____
Abatement Contractor: NEW HORIZONS Crew Comp: 1 SUP, 1 WORKER
Job Scope: KITCHEN + STORAGE ROOMS + RR
Daily Job Description: CLEARANCE + TEARDOWN

Comments (Include: Engineering controls/work practices; significant events, contacts, visitors; Air sample location; Personal pump use):

(06:50) ELLIS/NH ON SITE. CLEARANCE SAMPLES TO BE COLLECTED IN KITCHEN. (07:12) AIR SAMPLE SET. NH BEGINS REMOVING DECONS @ STORAGE ROOMS & RR ~~RR~~ & APPLYING CRITICAL BARRIERS, UNTIL RESULTS ARE IN. LEAD & ASB WASTE REMAINS STORED IN RR.
(09:08) AIR SAMPLE PULLED & READ. ELLIS APPROVES FOR TEARDOWN.
(10:15) ELLIS - HERMOSA BEACH ON SITE, SIGNS MANIFEST. WASTE AMOUNT ISN'T WRITTEN YET UNTIL DRIVER ARRIVES ON SITE. NH CONTINUES VACUUM & WIPING EDGES. LEAD WASTE WILL REMAIN ON SITE @ RR PENDING CHARACTER, RESULTS. (11:00) DRIVER ON SITE. 24 BAGS TOTAL. ELLIS VERIFIED ALSO. EQUIPMENT LOADING. (11:30) ELLIS OFF SITE.

(2)

Date: 10/25/17

AIR SAMPLE DATA SHEET

Sample Method: NIOSH 7400

Job No.: 17-454

Sample Media: 0.8m

Client: CITY OF HERMOSA BEACH

Location: CLARK BLDG,
861 VALLEY DR.

SAMPLE NO.	SAMPLE LOCATION	PUMP NO.	TIME		ROTO. SETTING		CALC. FLOW RATE	TOTAL TIME (MINUTES)	TOTAL VOLUME (LITERS)	FIBERS/FIELDS	RESULTS FIBERS/CC
			START	STOP	START	STOP					
3136	KITCHEN CLEARANCE		7:12	9:08	12.0	12.0	12.0	116	1,392	6/100	0.002
3119	FIELD BLANK	-	-	-	-	-	-	-	-	6/100	-

SAMPLED BY: LS

ANALYZED BY: LS

COMMENTS: L.O.D. (Limit of Detection) For this method: 5.5 fibers/100 fields per NIOSH 7400A.

Ellis Environmental Mgt., Inc.

430 Silver Spur Road, Suite 201, Rancho Palos Verdes, CA 90275

Office (310) 544 1837 Fax (310) 544 2167

www.ellisenvironmental.com



AmeriSci Los Angeles

24416 S. Main Street, Ste 308
Carson, California 90745
TEL: (310) 834-4868 • FAX: (310) 834-4772

AmeriSci Job #: 417101329

Lead Analysis Results

Date Received: 10/25/17

Date Analyzed: 10/26/17

Air

NIOSH 7082

Ellis Environmental Management, Inc.

Rancho Palos Verdes, CA

Job Site: 17-454; City Of HB; Clark Bldg.

AmeriSci #	Client Number	Sample Location	Volume (m3)	Lead Content (µg/m3)
417101329				
01	10231L	Lead Air Monitor - RR Decon	0.52	<9.6
02	FB	Field Blank	1	<5.0
03	1024L2	Lead Air Monitor - Mobile	0.22	<23

AmeriSci Reporting Limit is 5 ug prior to any dilutions due to high analyte concentrations or matrix interferences. AmeriSci does not correct sample results by the blank value. All analytical batch data met quality control criteria unless otherwise noted. CA ELAP No. 2322.

OSHA PEL 50 ug/m3 (General Industry). Cal OSHA Limit is 30 ug/m3.

Reviewed by: _____

Analyzed by: 
Soheir Galess, Chemist

417 101329

Ellis Environmental Management, Inc.

Project No.: 17-454
 Client: City of HB
 Location: Clark Bldg.

430 Silver Spur Road, Suite 201
 Rancho Palos Verdes, CA 90275
 (310) 544-1837 (tel)
 (310) 544-2167 (fax)

Sampler: SC
 Sheet 1 of 1

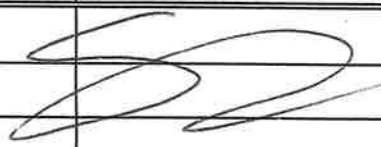
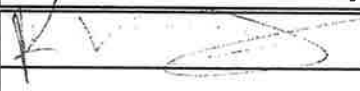
CHAIN OF CUSTODY RECORD

Sample Number	Description	Date	Time	H2O	Air	Solid	Tests Required
10231L	Lead air monitor-RR decon	10-23	AM		✓		Flame AAS-lead air-518L
FB	Field Blank	10-24	AM				" - 0L
1024L2	Lead air monitor-mobile	10-24	AM				" - 218L
RR-T	Men's RR Clearance	10-24	PM				Flame AAS lead wipe 1 s.f. E
ST-2	Storage 2 Clearance	10-24	PM				" "
ST-1	Storage 1 tape lift	↓	PM				mod tape lift
O1	Outdoor tape lift	↓	PM				↓ ↓
O2	" "						

3 day
 RUSH

Turnaround: ___ same day ___ 24 hrs. ___ 48 hrs. ___ 3 days ___ 5 days (Standard)

Special Instructions:

Date	Relinquished By	Received By	Date
10-25-17			10/25/17 @ 08:00



Laboratory Report

Report Date: 10/27/2017
 Workorder No: 417101297

Customer: **Ellis Environmental Management, Inc.**
 430 Silver Spur Road, Suit 201
 Rancho Palos Verdes, CA 90275

Attention: Duane Behrens

Subject: **17-454; HB, Clark Bldg.**

Sample 1: S-L1 Description: Storage Rm Waste
 Collection Date: 10/23/2017 Received Date: 10/23/2017 Time: 15:30
 Matrix: Solid

<u>Parameter</u>	<u>Method</u>	<u>Results</u>	<u>Unit</u>	<u>PQL</u>	<u>Tech</u>	<u>Analysis Date</u>	<u>Qual</u>
Lead, TTLC, AAS	EPA 3050B/7000B	140	mg/kg	20	MP	10/24/2017	
STLC Extraction-Metals	CA WET				SG	10/24/2017	
Lead, WET, ICP	EPA 3010A/6010C	<0.40	mg/L	0.40	MP	10/26/2017	
TCLP Extraction-Metals	SW-846 Method 1311				SG	10/24/2017	
Lead, TCLP, AAS	EPA 3010A/7000B	<2.0	mg/L	2.0	SG	10/25/2017	

Sample 2: T-L2 Description: Mens RR Tile Waste
 Collection Date: 10/23/2017 Received Date: 10/23/2017 Time: 15:30
 Matrix: Solid

<u>Parameter</u>	<u>Method</u>	<u>Results</u>	<u>Unit</u>	<u>PQL</u>	<u>Tech</u>	<u>Analysis Date</u>	<u>Qual</u>
Lead, TTLC, AAS	EPA 3050B/7000B	4100	mg/kg	200	MP	10/24/2017	
TCLP Extraction-Metals	SW-846 Method 1311				SG	10/24/2017	
Lead, TCLP, AAS	EPA 3010A/7000B	<2.0	mg/L	2.0	SG	10/25/2017	

Sample 3: K-L3 Description: Kitchen Waste
 Collection Date: 10/23/2017 Received Date: 10/23/2017 Time: 15:30
 Matrix: Solid

<u>Parameter</u>	<u>Method</u>	<u>Results</u>	<u>Unit</u>	<u>PQL</u>	<u>Tech</u>	<u>Analysis Date</u>	<u>Qual</u>
Lead, TTLC, AAS	EPA 3050B/7000B	350	mg/kg	20	MP	10/24/2017	
STLC Extraction-Metals	CA WET				SG	10/24/2017	
Lead, WET, ICP	EPA 3010A/6010C	8.2	mg/L	0.40	MP	10/26/2017	
TCLP Extraction-Metals	SW-846 Method 1311				SG	10/24/2017	
Lead, TCLP, AAS	EPA 3010A/7000B	<2.0	mg/L	2.0	SG	10/25/2017	



AmeriSci Los Angeles
24416 S Main St., Ste. 308
Carson, CA 90745
Phone: (310) 834-4868 Fax: (310) 834-4772

Customer: **Ellis Environmental Management, Inc.**

Workorder No: **417101297**

AmeriSci Reporting Limit is represented by the PQL. The analytical results within this report relate only to the specific compounds and samples investigated, and may not necessarily reflect other apparently similar material from a similar location. This report shall not be reproduced, except in full, without the written approval of AmeriSci Los Angeles. All analytical Batch data met quality control criteria unless other wise noted.

To the best of my knowledge this report is true and accurate.

Authorized by/Title: 
Minh Phung / Metal Superv.

Date: 10/27/2017

417 101297

Ellis Environmental Management, Inc.

430 Silver Spur Road, Suite 201
Rancho Palos Verdes, CA 90275
(310) 544-1837 (tel)
(310) 544-2167 (fax)

Project No.: 17-454

Sampler: SC

Client: HB

Location: Clark Bldg.

CHAIN OF CUSTODY RECORD

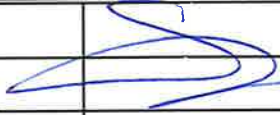
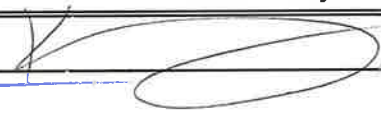
Sheet 1 of 1

Sample Number	Description	Date	Time	H2O	Air	Solid	Tests Required
S-L1	Storage Rm. Waste	10-23	4M			✓	TTLc → STLC → TCLP lead
T-L2	Mens RR Tile Waste	↓	↓			↓	"
K-L3	Kitchen Waste	↓	↓			↓	"

-as needed

Turnaround: ___ same day 24 hrs. ___ 48 hrs. ___ 3 days ___ 5 days (Standard)

Special Instructions: TTLc → STLC → TCLP if needed.

Date	Relinquished By	Received By	Date
10-23-17			10/23/17 @ 1530



AmeriSci Los Angeles
 24416 S Main St., Ste. 308
 Carson, CA 90745
 Phone: (310) 834-4868 Fax: (310) 834-4772

Laboratory Report

Report Date: 10/24/2017
 Workorder No: 417101297

Customer: **Ellis Environmental Management, Inc.**
 430 Silver Spur Road, Suit 201
 Rancho Palos Verdes, CA 90275

Attention: Duane Behrens

Subject: **17-454; HB, Clark Bldg.**

Sample 1: S-L1 Description: Storage Rm Waste
 Collection Date: 10/23/2017 Received Date: 10/23/2017 Time: 15:30
 Matirx: Solid

<u>Parameter</u>	<u>Method</u>	<u>Results</u>	<u>Unit</u>	<u>PQL</u>	<u>Tech</u>	<u>Analysis Date</u>	<u>Qual</u>
Lead, TTLC, AAS	EPA 3050B/7000B	140	mg/kg	20	MP	10/24/2017	

Sample 2: T-L2 Description: Mens RR Tile Waste
 Collection Date: 10/23/2017 Received Date: 10/23/2017 Time: 15:30
 Matirx: Solid

<u>Parameter</u>	<u>Method</u>	<u>Results</u>	<u>Unit</u>	<u>PQL</u>	<u>Tech</u>	<u>Analysis Date</u>	<u>Qual</u>
Lead, TTLC, AAS	EPA 3050B/7000B	4100	mg/kg	200	MP	10/24/2017	

Sample 3: K-L3 Description: Kitchen Waste
 Collection Date: 10/23/2017 Received Date: 10/23/2017 Time: 15:30
 Matirx: Solid

<u>Parameter</u>	<u>Method</u>	<u>Results</u>	<u>Unit</u>	<u>PQL</u>	<u>Tech</u>	<u>Analysis Date</u>	<u>Qual</u>
Lead, TTLC, AAS	EPA 3050B/7000B	350	mg/kg	20	MP	10/24/2017	

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To the best of my knowledge this report is true and accurate.

Authorized by/Title: 
 Minh Phung / Metal Superv.

Date: 10/24/2017

417 101297

Ellis Environmental Management, Inc.

430 Silver Spur Road, Suite 201
 Rancho Palos Verdes, CA 90275
 (310) 544-1837 (tel)
 (310) 544-2167 (fax)

Project No.: 17-454

Sampler: SC

Client: HB

Location: Clark Bldg.

CHAIN OF CUSTODY RECORD

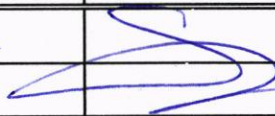

Sheet 1 of 1

Sample Number	Description	Date	Time	H2O	Air	Solid	Tests Required
S-L1	Storage Rm. Waste	10-23	4M			✓	TTLIC → STLC → TCLP lead
T-L2	Mens RR Tile waste	↓	↓			↓	" "
K-L3	Kitchen waste	↓	↓			↓	" "

-as needed

Turnaround: ___ same day 24 hrs. ___ 48 hrs. ___ 3 days ___ 5 days (Standard)

Special Instructions: TTLIC → STLC → TCLP if needed.

Date	Relinquished By	Received By	Date
10-23-17			10/23/17 01530



AmeriSci Los Angeles

24416 S. Main Street, Ste 308
Carson, California 90745
TEL: (310) 834-4868 • FAX: (310) 834-4772

AmeriSci Job #: 417101330

Lead Analysis Results

Date Received: 10/25/17

Date Analyzed: 10/25/17

Dust Wipes

EPA Method 3050B/7000B

Ellis Environmental Management, Inc.

Rancho Palos Verdes, CA

Job Site: 17-454; City Of HB; Clark Bldg.

AmeriSci #	Client Number	Sample Location	Area (ft ²)	Lead Content (µg/ft ²)
417101330				
01	RR-T	Men's RR Clearance	1	37
02	ST-2	Storage 2 Clearance	1	13

AmeriSci Reporting Limit is 10 ug/wipe, prior to any dilutions due to high analyte concentrations or matrix interferences. AmeriSci does not correct sample results by the blank value. All analytical batch data met quality control criteria unless otherwise noted. CA ELAP No. 2322.

HUD guidelines for dust wipes are:
40 ug/ft² for floors, 250 ug/ft² for interior window sills, 400 ug/ft² for interior window

Reviewed by: _____

Analyzed by:  _____

Minh Phung, Chemist

417 101330

Ellis Environmental Management, Inc.

430 Silver Spur Road, Suite 201
 Rancho Palos Verdes, CA 90275
 (310) 544-1837 (tel)
 (310) 544-2167 (fax)

Project No.: 17-454

Sampler: SC

Client: City of HB

Location: Clark Bldg.

CHAIN OF CUSTODY RECORD

Sheet 1 of 1



Sample Number	Description	Date	Time	H2O	Air	Solid	Tests Required
10231L	Lead air monitor-RR deion	10-23	AM		✓		Flame AAS-lead air-518L
FB	Field Blank	10-24	AM				" " - 0L
1024LZ	Lead air monitor-mobile	10-24	AM				" " - 218L
RR-T	Men's RR Clearance	10-24	PM				Flame AAS lead wipe 1 s.f. E
ST-2	Storage 2 Clearance	10-24	PM				" "
ST-1	Storage 1 tape lift	↓	PM				mold tape lift
01	Outdoor tape lift	↓	PM				↓ ↓
02	" "						

3 day

RUSH

Turnaround: same day 24 hrs. 48 hrs. 3 days 5 days (Standard)

Special Instructions:

Date	Relinquished By	Received By	Date
10-25-17			10/25/17 6:08 PM