PROJECT MANUAL

FOR

Kitchen Modernization at
Blandford Elementary School

2601 Blandford Drive
Rowland Heights, CA 91748

CO-AR Project No.:
202315

Prepared for

Rowland Unified School District
1830 Nogales Street
Rowland Heights, CA 91748

March 4, 2024

DSA A# 03-124069

CO-AR Design, Inc.
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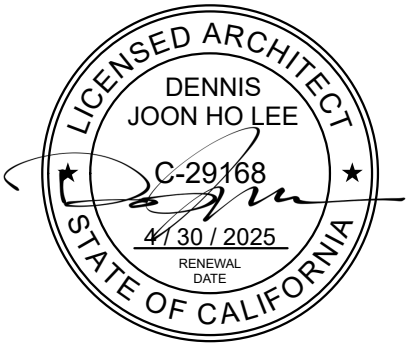

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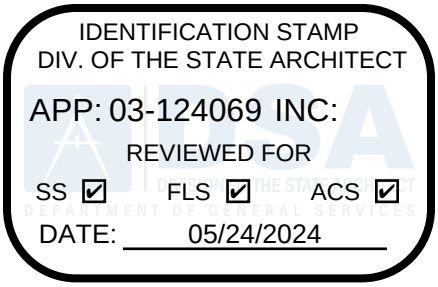

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SPECIFICATIONS

TABLE OF CONTENTS

END OF TABLE OF CONTENTS

SECTION 01 1100

SUMMARY OF WORK

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Work Included.

B. Work by Owner.

C. Owner Furnished Products.

D. Contractor Use of Site and Premises

E. Work Sequence.

F. Owner Occupancy.

1.02 WORK INCLUDED:

A. The furnishing of all labor, materials, equipment, services, and incidentals necessary for Work of the Kitchen Modernization, at Blandford Elementary School located at 2601 Blandford Drive, Rowland Heights, CA 91748, as set forth in the Construction Documents which include, but are not limited to, the Drawings, Addenda and Specifications.

B. The services of a California Registered Professional Engineer or a Professional recognized by the State of California to review and certify the final installed lighting control system, per specification section 26 5100 LIGHTING FIXTURES, 3.02 C.

1.03 WORK BY OWNER:

A. The Owner will award a contract which will commence on the owner's notice to proceed. Work under this contract includes:

1. Base Bid

2. Any alternate bid item accepted by the District

B. Items noted “NIC” (Not in Contract) will be furnished and installed by Owner.

C. Owner will retain possession of the following items prior to start of work:

1. Any demolition item identified by Owner

D. Contractor will remove, protect, and deliver items for Owner to take possession of the following items prior to start of work:

1. Any existing item identified by Owner.

1.04 OWNER FURNISHED PRODUCTS:

A. Items noted “OFCI” (Owner-Furnished Contractor Installed) will be furnished by Owner and installed by Contractor.

B. Items noted “OFOI” (Owner-Furnished Owner Installed) will be furnished by Owner and installed by Owner.

C. Owner's Responsibilities:

1. Arrange for and deliver Owner reviewed Shop Drawings, Product Data, and Samples to Contractor.

2. Arrange and pay for OFCI Product delivery to site.

3. On delivery, inspect Products jointly with Contractor.

4. Submit claims for transportation damage and replace damaged, defective, or deficient items.

5. Arrange for manufacturer's warranties, inspections, and service.

D. Contractor's Responsibilities:

1. Review Owner reviewed Shop Drawings, Product Data, and Samples.

2. Receive and upload Products at site; inspect for completeness or damage, jointly with Owner.

3. Handle, store, install, and finish Products.

4. Repair or replace items damaged after receipt.

E. Products furnished and installed by Owner (OFOI):

1. As noted on plans.

F. Items furnished by Owner for installation by Contractor (OFCI):

1. As noted on plans.

1.05 CONTRACTOR USE OF SITE AND PREMISES:

A. Limit use of site and premises to allow:

1. Owner occupancy.

2. Complete school site use by students and District personnel.

3. Work by others and Work by Owner.

B. Construction Operations: Limited to area as permitted by Owner.

1.06 WORK SEQUENCE:

A. Construct work in phases to accommodate Owner's occupancy requirements during the construction period; coordinate construction schedule and operations with Owner or his designated project representative.

1.07 OWNER OCCUPANCY:

A. The Owner will occupy the site premises during entire period of construction, for the conduct of his normal operations.

B. Cooperate with Owner to minimize conflict, and to facilitate Owner's operations.

C. Schedule work to accommodate Owner occupancy.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 01 2000

PRELIMINARY WORK

PART 1 - GENERAL

1.01 SCOPE:

A. Furnish, install and do all preliminary work as shown on the drawings and as specified in this section, including but not limited to the following:

1. All site work including all field engineering as indicated on drawings and as required for the completion of the project.

1.02 EXAMINATION OF SITE AND THE CONTRACT DOCUMENTS:

A. Before submitting a bid, the bidders shall carefully examine the contract documents, shall visit the site, and shall fully inform themselves as to all existing conditions and limitations and shall include in their proposal a sum to cover all items included in the contract documents.

1.03 LAYOUT OF WORK:

A. Contractor shall notify the Architect at least three (3) days prior to layout of the work if additional data will be required.

B. Location and elevations of all structures to be constructed under this contract are shown on the drawings and unless any discrepancies therein are brought in writing, to the attention of the Architect prior to beginning of construction, Contractor will be held responsible for the proper locations and elevations as shown and as intended.

C. Owner will establish property corners and property lines and will designate the reference benchmark as necessary.

D. Contractor shall layout the work and shall establish and maintain necessary markers, auxiliary benchmarks, stakes and batter boards, and shall be responsible for the accuracy of same.

E. Contractor shall layout, as a guide to all trades and to his subcontractors, the exact locations of all walls, partitions, floors, ceiling, doors, windows, and openings.

1.04 SCAFFOLDING AND TEMPORARY CONSTRUCTION:

A. Provide temporary construction such as scaffolding, stairs, hoists and similar structures as required for all trades. Employ and pay for a licensed engineer to design and supervise temporary structures including bracing, shoring, crane capacity, crane support, scaffolding and similar construction. Visits to the site by Architect or Structural Engineer shall not include inspection or certification of these items.

1.05 BARRICADES:

A. The Contractor shall construct and maintain for the duration of the contract an effective barricade around the perimeter of all work in progress subject to governing agency approval. The barricade shall be rigidly constructed of chain link fencing, plywood, or other effective materials, a minimum of 6 feet high.

1.06 TEMPORARY HEATING:

A. The Contractor shall provide heat, fuel, and services necessary to protect all work and materials against injury from dampness and cold until final acceptance of all work and materials in the contract, unless the buildings are fully occupied by the Owner prior to such acceptance in which case the Owner shall assume all expenses of heating from date of occupancy. The Contractor shall provide heat as follows:

1. At all times during the placing, setting, and curing of concrete, provide sufficient heat to ensure the heating of the spaces involved to not less than 50 degrees Fahrenheit.

2. From the beginning of the application of plaster and during the setting and curing period, provide sufficient heat to produce a temperature in the spaces involved not less than 50 degrees Fahrenheit.

3. For a period of ten (10) days previous to the placing of interior wood finish and throughout the placing of this and other interior finishing, varnishing, painting, etc., and until final acceptance of the work or until full occupancy by the Owner, provide sufficient heat to produce a temperature of not less than 65 degrees Fahrenheit.

1.07 INTERRUPTION OF SERVICES:

A. The Contractor shall coordinate the work of the several trades to keep the interruption of services, particularly water, gas, electric, sewer, etc., to a minimum. Where possible, changes in utility service shall be made when office areas are not in use (before or after office hours or on weekend days). Should it be necessary to interrupt services while office areas are in use, the Contractor is required to give the Owner 48 hours written notice, and it is required that such interruption be limited to 60 minutes maximum time per day for each utility service interrupted. If additional time is required, arrangements must be mutually agreed upon in advance.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 01 2500

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Product options.

B. Substitutions.

1.02 DEFINITIONS

A. Requests for changes in products, materials, or equipment required by Contract Documents proposed by the Contractor prior to and after award of the Contract are considered requests for substitutions. The following are not considered substitutions:

1. Revisions to Contract Documents requested by the Owner or Architect.

2. Specified options of products, materials, and equipment included in Contract Documents.

1.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers with Provision for Substitution: Products of manufacturers named and meeting specifications with substitution of products or manufacturer only when submitted under provisions of this section.

C. Products Specified by Naming One or More Manufacturers without Provision for Substitution: No substitution allowed.

1.04 LIMITATIONS ON SUBSTITUTIONS SUBMITTED PRIOR TO THE RECEIPT OF BIDS

A. The Bid shall be based upon the standards of quality established by those items of equipment and/or materials which are specifically identified in the Contract Documents.

B. Architect may consider requests for substitutions of specified equipment and/or materials only when requests are received by Architect a minimum of 21 days prior to the date established for the receipt of bids.

C. Consideration by Architect of a substitution request will be made only if request is made in strict conformance with provisions of this section.

D. Burden of proof of merit of requested substitution is the responsibility of the entity requesting the substitution.

E. It is the sole responsibility of the entity requesting the substitution to establish proper content of submittal for requests for substitutions. Incomplete submittals will be rejected.

F. Architect's decision on substitution requests are final and do not require documentation or justification.

G. When substitution is not accepted, provide specified product.

H. Substitute products shall not be included within the bid without written acceptance by Addendum.

1.05 LIMITATIONS ON SUBSTITUTIONS SUBMITTED AFTER THE AWARD OF THE CONTRACT

A. The Contract is based upon the standards of quality established by those items of equipment and/or materials which are specifically identified in the Contract Documents.

B. Consideration by Architect of substitution requests received after the established date of the receipt of bids or contract award will only be made when one or more of the following conditions are met and documented:

1. Specified item fails to comply with regulatory requirements.

2. Specified item has been discontinued.

3. Specified item, through no fault of the Contractor, is unavailable in the time frame required to meet project schedule.

4. Specified item, through subsequent information disclosure, will not perform properly or fit in designated space.

5. Manufacturer declares specified product to be unsuitable for use intended or refuses to warrant installation of product.

6. Substitution would be, in the sole judgement of the Architect, a substantial benefit to the Owner in terms of cost, time, energy conservation, or other consideration of merit.

C. Notwithstanding the provisions of Article 1.04 of this section and the above, the Architect may consider a substitution request after the date of the receipt of bids or contract award, if in the sole discretion of the Architect, there appears to be just cause for such a request. The acceptance of such a late request does not waive any other requirement as stated herein.

D. Consideration by Architect of a substitution request will be made only if request is made in strict conformance with provisions of this section.

E. Substitutions will not be considered when they are indicated or implied on shop drawings or product data submittals without separate written request as required by provisions of this section.

F. Review of shop drawings does not constitute acceptance of substitutions indicated or implied on shop drawings.

G. Substitutions will not be considered when requested or submitted directly by subcontractor or supplier.

H. Substitutions will not be considered as a result of the failure to pursue the work promptly or coordinate activities properly.

I. Burden of proof of merit of requested substitution is the responsibility of the Contractor.

J. It is the sole responsibility of the Contractor to establish proper content of submittal for requests for substitutions. Incomplete submittals will be rejected.

K. Owner shall receive full benefit of any cost reduction as a result of any request for substitution.

L. Architect's decision on substitution requests is final and does not require documentation or justification.

M. When substitution is not accepted, provide specified product.

N. Substitute products shall not be ordered or installed without written acceptance.

1.06 REGULATORY REQUIREMENTS

A. It shall be the responsibility of the entity requesting the substitution to obtain all regulatory approvals required for proposed substitutions.

B. All regulatory approvals shall be obtained for proposed substitutions prior to submittal of substitution request to Architect.

C. All costs incurred by the Owner in obtaining regulatory approvals for proposed substitutions to include the costs of the Architect and any authority having jurisdiction over the project shall be reimbursed to the Owner. Costs of these services shall be reimbursed regardless of final acceptance or rejection of substitution.

D. Substitutions of materials or work procedures which affect the health, safety and welfare of the public shall have prior approval of the Division of the State Architect (DSA) field representative.

1.07 SUBSTITUTION REPRESENTATION

A. In submitting a request for substitution, the entity requesting the substitution makes the representation that he or she:

1. Has investigated the proposed substitution and has determined that it meets or exceeds the quality level of the specified product.

2. Will provide the same warranty or guarantee for the substitution as for the specified product.

3. Will coordinate installation and make changes to other work which may be required for the work to be completed with no additional cost to the Owner.

4. Waives claims for additional cost or time extension which may subsequently become apparent.

5. Will reimburse Owner for the cost of Architect's review or redesign services associated with substitution request.

1.08 SUBMITTAL PROCEDURE

A. Submit six copies of each request.

B. Submit request with Architect's Substitution Request Form. Form may be obtained at the office of the Architect. Substitution requests received without request form will be returned unreviewed.

C. Limit each request to one proposed substitution.

D. Request to include sufficient data so that direct comparison of proposed substitution can be made.

E. Provide complete documentation for each request. Documentation shall include the following information, as appropriate, as a minimum:

1. Statement of cause for substitution request.

2. Identify product by specification section and article number.

3. Provide manufacturer's name, address, and phone number. List fabricators, suppliers, and installers as appropriate.

4. List similar projects where proposed substitution has been used, dates of installation and names of Architect and Owner.

5. List availability of maintenance services and replacement materials.

6. Documented or confirmation of regulatory approval.

7. Product data, including drawings and descriptions of products.

8. Fabrication and installation procedures.

9. Samples of proposed substitutions.

10. Itemized comparison of significant qualities of the proposed substitution with those of the product specified. Significant qualities may include size, weight, durability, performance requirements and visual effects.

11. Coordination information, including a list of changes or modifications needed to other items of work that will become necessary to accommodate proposed substitution.

12. Statement on the substitutions effect on the construction schedule.

13. Cost information including a proposal of the net change, if any, in the Contract sum if the substitution is submitted after the receipt of bids or contract award.

14. Certification that the substitution is equal to or better in every respect to that required by the Contract Documents and that substitution will perform adequately in the application intended.

15. Waiver of right to additional payment or time that may subsequently become necessary because of failure of substitution to perform adequately.

F. Inadequate warranty, vagueness of submittal, failure to meet specified requirements, or submittal of insufficient data will be cause for rejection of substitution request.

1.09 ARCHITECT'S REVIEW

A. Within 14 days of receipt of request for substitution, the Architect will accept or reject proposed substitution.

B. If a decision on a substitution cannot be made within the time allocated, the product specified shall be used.

C. There shall be no claim for additional time for review of proposed substitutions.

D. Final acceptance of a substitution submitted prior to the date established for the receipt of bids will be in the form of an addendum.

E. Final acceptance of a substitution submitted after the award of the contract will be in the form of a Change Order.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 01 2600

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections include the following:

1. Division 1 Section “Substitution Procedures” for administrative procedures for handling requests for substitutions made after Contract award.

1.03 MINOR CHANGES IN THE WORK

A. Architect may issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, or Changes not affecting the Structural Safety, Access Compliance or Fire & Life Safety portions of the work, on AIA Document G710, “Architect's Supplemental Instructions” or an equivalent form acceptable to District and subject to DSA IR A-6 Construction Change Document Submittal and Approval Process (Title 24, Part 1, California Code or Regulations, Section 4-338) requirements for DSA Construction Change Document – Category B.

1.04 REQUEST FOR PROPOSAL (RFP)

A. Owner-Initiated Proposal Requests: Architect may issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposal Requests issued are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed changes.

2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

   (A) Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

   (B) Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

   (C) Include costs of labor and supervision directly attributable to the change.

   (D) Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

1.05 CONSTRUCTION CHANGE PROCESS - DSA

A. Changes or alterations of the approved plans or specifications after a contract for the work has been let affecting the Structural, Access or Fire-Life Safety portions of the project shall be made only by means of Construction Change Documents submitted to and approved by DSA prior to commencement of the work shown thereon. Construction Change Documents shall comply with DSA IR A-6 Construction Change Document Submittal and Approval Process (Title 23, Part 1, California Code or Regulations, Section 4-338) requirements. Construction Change Documents shall be made using DSA form 141 and state the reason for the change and the scope of work to be accomplished, and, where necessary, shall be accompanied by supplementary drawings referenced in the text of the change order. All Construction Change Documents and supplementary drawings shall be stamped and signed by the architect or engineer in general responsible charge of observation of the work of construction of the project and by the architect or registered engineer delegated responsibility for observation of the portion of the work of construction affected by the change order, shall bear the approval of the school board and shall indicate the associated change in the project cost, if any. One copy of each Construction Change Document is required for the files of DSA.

B. Construction Change Documents shall be signed by Architect of Record, Structural Engineer (when applicable), Delegated Professional Engineer (when applicable), and DSA.

C. No changes shall be made to approved documents without DSA approval.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 01 3216

PROGRESS SCHEDULE

PART 1 - GENERAL

1.01 DEFINITIONS:

A. Day: As used throughout the Contract, the work “day” means “calendar day” unless otherwise indicated.

B. Adverse weather that is normal for the area and the season shall be considered in the Construction Schedule.

1.02 QUALITY ASSURANCE:

A. Reliance Upon Published Schedule.

1. The published schedule, as accepted, shall be an integral part of the contract and will establish interim Contract completion dates for various activities.

2. Should any activity fail to be completed within five (5) days after the stipulated schedule date, the Owner shall reserve the right to order the contractor to submit a detailed recovery schedule showing all recovery dates and durations to fully recover the schedule.

3. Should any activity fail to be completed within 10 days after the stipulated schedule date, the Owner shall have the right to order the Contractor to expedite completion of the activity by whatever means the Owner deems appropriate and necessary, without additional compensation to the Contractor, and as set forth in the General Conditions of the contract.

4. Should any activity fail behind schedule, the Owner shall have the right to perform the activity or have the activity performed by whatever method the Owner may deem appropriate, and as set forth in the General Conditions of the Contract.

5. Cost incurred by the Owner in connection with expediting construction shall be deducted from the Contract amount.

6. Failure by the Owner to exercise the option to either order the Contractor to expedite an activity or to expedite the activity by other means, will not be considered a precedent for any other activities nor a waiver of the Owner's rights to exercise his rights on subsequent occasions.

PART 2 - PRODUCTS

2.01 (NOT USED)

PART 3 - EXECUTION

3.01 (NOT USED)

END OF SECTION

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, OWNER and others.

1.02 RELATED REQUIREMENTS

A. Section 01 2500: Substitution Procedures.

B. Section 01 4523: Testing and Inspection.

C. Section 01 7329: Cutting and Patching.

D. Section 01 7700: Contract Closeout.

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 and process them in accordance with Section 01 2500 Substitution Procedures.

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 OWNER. ARCHITECT will not accept submittals received from sources other than from CONTRACTOR.

C. After ARCHITECT'S review, ARCHITECT will transmit submittals to OWNER and OWNER shall further distribute to CONTRACTOR, INSPECTOR and others as required. Work shall not commence, unless otherwise approved by OWNER, 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 OWNER, 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 OWNER on the first of each month, or as required by OWNER.

5. CONTRACTOR shall allow in the Construction Schedule, at least sixteen 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 OWNER, CONTRACTOR shall allow a minimum of eighteen days following ARCHITECT receipt of submittal. Deferred approval items shall be allowed additional time for DSA review.

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 OWNER).

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 trade association standards.

c. Compliance with recognized testing agency standards.

d. Application of testing agency labels and seals.

e. Notation of dimensions verified by field measurement.

f. Notation of coordination requirements.

g. Notation of dimensions and required clearances.

h. Indicate performance characteristics and capacities.

i. 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: Same as denoted in Article 3.02.E.

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 OWNER 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 4213

ABBREVIATIONS AND ACRONYMS

&	AND
∠	ANGLE
@	AT
CL	CENTERLINE
Ø	DIAMETER OR ROUND
⊥	PERPENDICULAR
#	POUND OR NUMBER
(E)	EXISTING
(N)	NEW
A.B.	ANCHOR BOLT
A.C.	ASPHALTIC CONCRETE
ACOUS.	ACOUSTICAL
A.D.	AREA DRAIN
ADDN.	ADDITION
ADJ.	ADJUSTABLE
A.F.F.	ABOVE FINISHED FLOOR
AGGR.	AGGREGATE
AL.	ALUMINUM
ALT.	ALTERNATE
APPROX.	APPROXIMATE
ARCH	ARCHITECTURAL
ASPH.	ASPHALT
AVE.	AVENUE
AWS	ARCHITECTURAL WOODWORK STANDARDS
BD.	BOARD
BLDG.	BUILDING
BLK.	BLOCK
BLKG.	BLOCKING
B.M.	BENCHMARK
BM.	BEAM
BOT.	BOTTOM
BTWN.	BETWEEN
B.W.	BOTH WAYS
CAB.	CABINET
C.B.	CATCH BASIN
CEM.	CEMENT
CER.	CERAMIC
CH.BD.	CHALKBOARD
C.I.	CAST IRON
CLG.	CEILING
CLO.	CLOSET
CLR.	CLEAR
C.M.U.	CONCRETE MASONRY UNIT
CNTR.	COUNTER
COL.	COLUMN
CONC.	CONCRETE
CONN.	CONNECTION
CONST.	CONSTRUCTION
CONT.	CONTINUOUS
CORR.	CORRIDOR
C.T.	CERAMIC TILE
CPT.	CARPET
CTR.	CENTER
CTSK.	COUNTERSUNK
DBL.	DOUBLE
DEPT.	DEPARTMENT
DET.	DETAIL
D.F.	DRINKING FOUNTAIN
DIA.	DIAMETER
DIAG.	DIAGONAL
DIM.	DIMENSION
DISP.	DISPENSER
D.O.	DOOR OPENING
DR.	DOOR
DS.	DOWNSPOUT
D.S.P.	DRY STANDPIPE
D.T.J.	DEEP TOOLED JOINT
DWG.	DRAWING
DWR.	DRAWER

E.	EAST
EA.	EACH
E.J.	EXPANSION JOINT
EL.	ELEVATION
ELEC.	ELECTRICAL
EMER.	EMERGENCY
ENCL.	ENCLOSURE
E.P.	ELECTRICAL PANELBOARD
EQ.	EQUAL
EQPT.	EQUIPMENT
EXP.	EXPANSION
EXPO.	EXPOSED
EXT.	EXTERIOR
E.W.C.	ELECTRIC WATER COOLER
F.A.	FIRE ALARM
F.D.	FLOOR DRAIN
FDN.	FOUNDATION
F.E.	FIRE EXTINGUISHER
F.E.C.	FIRE EXTINGUISHER CABINET
F.F.	FINISH FLOOR
F.H.	FIRE HYDRANT
F.H.C.	FIRE HOSE CABINET
F.H.M.S.	FLAT MACHINE SCREW
F.H.W.S.	FLAT HEAD WOOD SCREW
FIN.	FINISH
FIX.	FIXTURE
F.L.	FLOW LINE
FLASH.	FLASHING
FLR.	FLOOR
FLUOR.	FLUORESCENT
F.O.C.	FACE OF CONCRETE
F.O.F.	FACE OF FINISH
F.O.M.	FACE OF MASONRY
F.O.S.	FACE OF STUDS
FPRF.	FIREPROOF
F.S.	FLOOR SINK
FT.	FOOT OR FEET
FTG.	FOOTING
FURR.	FURRING
FUT.	FUTURE
GA.	GAGE
GALV.	GALVANIZED
G.B.	GRAB BAR
G.I.	GALVANIZED IRON
GL.	GLASS
GND.	GROUND
GR.	GRADE
GYP.	GYPSUM
GYP. WBD.	GYPSUM WALLBOARD
H.B.	HOSE BIBB
H.C.	HOLLOW CORE
H.D./HD	HEAVY DUTY
HDW.	HARDWARE
HDWD.	HARDWOOD
H.M.	HOLLOW METAL
HORIZ.	HORIZONTAL
HR.	HOUR
HT.	HEIGHT
IC.	INTERCOM
I.D.	INSIDE DIAMETER (DIM.)
INSUL.	INSULATION
INT.	INTERIOR
INV.	INVERT
ISA	INTERNATIONAL SYMBOL OF ACCESSIBILITY
JAN.	JANITOR
JT.	JOINT
KIT.	KITCHEN
KO.	KNOCKOUT
LAB.	LABORATORY
LAM.	LAMINATE or LAMINATED
LAV.	LAVATORY
LB.	POUND
L.F.	LINEAR FOOT/FEET
LIB.	LIBRARY
LKR.	LOCKER

MACH.	MACHINE
MATL.	MATERIAL
MAX.	MAXIMUM
MEZZ.	MEZZANINE
M.C.	MEDICINE CABINET
M.D.O.	MEDIUM DENSITY OVERLAY
MECH.	MECHANICAL
MEMB.	MEMBRANE
MFG.	MANUFACTURING
MFR.	MANUFACTURER
MH.	MANHOLE
MIN.	MINIMUM
MIR.	MIRROR
MISC.	MISCELLANEOUS
M.O.	MASONRY OPENING
MTD.	MOUNTED
MUL.	MULLION
MTL.	METAL
N.	NORTH
NAT.	NATURAL
N.I.C.	NOT IN CONTRACT
NO. or #	NUMBER
NOM.	NOMINAL
N.T.S.	NOT TO SCALE
O.A.	OVERALL
OAR	OWNER AUTHORIZED REPRESENTATIVE
OBS.	OBSCURE
O.C.	ON CENTER
O.D.	OUTSIDE DIAMETER (DIM.)
O.F.C.I.	OWNER FURNISHED - CONTRACTOR INSTALLED
O.F.O.I.	OWNER FURNISHED - OWNER INSTALLED
OFF.	OFFICE
OPNG.	OPENING
OPP.	OPPOSITE
ORG.	ORIGINAL
OSB	ORIENTED STRAND BOARD
PL.	PLATE
P. LAM.	PLASTIC LAMINATE
PLAS.	PLASTER
PLYWD.	PLYWOOD
PNL.	PANEL
POL.	POLISH
PR.	PAIR
PRCST.	PRE-CAST
P.S.F.	PRE-FINISHED STEEL FRAME
P.S.I.	POUNDS PER SQUARE INCH
PT.	POINT
P.T.D.	PAPER TOWEL DISPENSER
P.T.D./R.	COMBINATION PAPER TOWEL DISPENSER & RECEPTACLE
PTN.	PARTITION
P.T.R.	PAPER TOWEL RECEPTACLE
Q.T.	QUARRY TILE
R.	RISER
RAD.	RADIUS
R.D.	ROOF DRAIN
REF.	REFERENCE
REFR.	REFRIGERATOR
RGTR.	REGISTER
REINF.	REINFORCED
REQ'D.	REQUIRED
RESIL.	RESILIENT
REV.	REVISE
R.H.M.B.	ROUND HEAD MACHINE BOLT
R.H.W.S.	ROUND HEAD WOOD SCREW
RM.	ROOM
RND.	ROUND
R.O.	ROUND OPENING
RWD.	REDWOOD
S.	SOUTH
S.C.	SOLID CORE
S.C.D.	SEAT COVER DISPENSER

SCHED.	SCHEDULE
S.D.	SOAP DISPENSER
SECT.	SECTION
S.F.	SQUARE FOOT/FEET
SH.	SHELF
SHR.	SHOWER
SHT.	SHEET
SIM.	SIMILAR
S.J.	SAWN JOINT
S.M.S.	SHEET METAL SCREW
S.N.D.	SANITARY NAPKIN DISPENSER
S.N.R.	SANITARY NAPKIN RECEPTACLE
SPEC.	SPECIFICATION
SQ.	SQUARE
S.SK.	SERVICE SINK
SST./S.S.	STAINLESS STEEL
STA.	STATION
STD.	STANDARD
STL.	STEEL
STOR.	STORAGE
STRUCT.	STRUCTURAL
SUSP.	SUSPENDED
SYM.	SYMMETRICAL
T.B.	TOWEL BAR
T.C.	TOP OF CURB
T.C.B.	TOP OF CATCH BASIN
TEL.	TELEPHONE
TER.	TERRAZZO
T.& G.	TONGUE AND GROOVE
THK.	THICK
T.O.C.	TOP OF CONCRETE
T.O.M.	TOP OF MASONRY
T.O.S.	TOP OF STEEL
T.O.P.	TOP OF PLATE/PARAPET
T.P.	TOP OF PAVEMENT
T.P.D.	TOILET PAPER DISPENSER
TRD.	TREAD
T.S.	TOP OF SHEATHING
T.V.	TELEVISION
T.W.	TOP OF WALL
TYP.	TYPICAL
U.C.	UNDER CUT
UG.	UNDERGROUND
UNF.	UNFINISHED
U.N.O.	UNLESS NOTED OTHERWISE
UR.	URINAL
V.C.T.	VINYL COMPOSITION TILES
VENT.	VENTILATE(R)
VERT.	VERTICAL
VEST.	VESTIBULE
V.G.D.F.	VERTICAL GRAIN DOUGLAS FIR
VOL.	VOLUME
W.	WEST
W.I.	WOODWORK INSTITUTE
W/	WITH
W.C.	WATER CLOSET
WD.	WOOD
WDO.	WINDOW
W.H.	WATER HEATER
W/O.	WITHOUT
WP.	WATERPROOFING
W.R.	WATER RESISTANT
WSCT.	WAINSCOT
WT.	WEIGHT
W.W.F.	WELDED WIRE FABRIC

SECTION 01 4500

QUALITY CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Quality assurance and control of installation.

B. Tolerances.

C. Field samples.

D. Mock-up.

E. Manufacturers' field services and reports.

1.02 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply fully with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform work by persons qualified to produce workmanship of specified quality.

F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.03 TOLERANCES

A. Monitor tolerance control of installed Products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturer's tolerances. Should manufacturer's tolerance conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust Products to appropriate dimensions; position before securing Products in place.

1.04 FIELD SAMPLES

A. Install field samples at the site as required by individual specifications Sections for review.

B. Acceptable samples represent a quality level for the Work.

C. Where field sample is specified in individual Sections to be removed, clear area after field sample has been accepted by Architect.

1.05 MOCK-UP

A. Tests will be performed under provisions identified in this section and identified in the respective product specification sections.

B. Assemble and erect specified items, with specified attachment and anchorage devices, flashings, seals and finishes.

C. Where mock-up is specified in individual Sections to be removed, clear area after mock-up has been accepted by Architect.

1.06 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. When specified in individual specification Sections, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance of equipment as applicable, and to initiate instructions when necessary.

B. Individuals to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

C. Submit report in duplicate within 15 days of observation to Architect for review.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Verify that utility services are available, of the correct characteristics, and in the correct locations.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

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) and the Division of the State Architect (DSA).

B. Related Requirements:

1. Section 03 3000 – Cast-in-Place Concrete.

2. 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.

F. Division of the State Architect (DSA) Interpretation Regulations (IR):

1. DSA IR 17-2 – Nondestructive Testing (N.D.T.) of Welds.

2. DSA IR 17-3 – Structural Welding Inspection.

3. DSA IR 17-8 – Sampling and Testing of High Strength Bolts, Nuts and Washers.

4. DSA IR 17-9 – High Strength Bolting Inspection.

5. DSA IR 17-10 – Sampling, Testing and Tagging of Reinforcing Bars.

6. DSA IR 17-11 – Identification, Sampling and Testing of Threaded Steel Anchor Bolts and Anchor Rods.

7. DSA IR 22-3 – Open Web Steel Joists and Joist Girders.

8. DSA IR 23-4 – Metal-Plate-Connected Wood Trusses.

9. DSA IR-23-8 – Manufactured Wood-Chord-Metal-Web Trusses.

1.03 REGULATORY REQUIREMENTS

A. Laboratories performing testing shall have DSA's Laboratory Evaluation and Acceptance Program 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 DSA approved DSA-103, Listing of Structural Tests & Special Inspections (T&I List). OAR will provide CONTRACTOR copy of DSA-103.

1.04 TESTS

A. OWNER will contract with a DSA 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 DSA required tests and inspections; however, the Testing Laboratory may be reimbursed by CONTRACTOR for such costs as specified or noted in related sections of the Contract Documents.

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.

G. CONTRACTOR shall provide an insulated curing box with the capacity for twenty concrete cylinders and will relocate said box and cylinders as rapidly as required in order to provide for progress of the Work.

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 Division of the State Architect, 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 OWNER in accordance with requirements of Title 24 of the California Code of Regulations with their duties specifically defined therein. Additional DSA Special Inspectors may be employed and assigned to the Work by OWNER in accordance with the requirements of the CBC and DSA.

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

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 1705A3.3.1, 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 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 inspections and non-destructive testing of structural steel elements shall be in conformance to CBC section 1705A.2.1.

C. 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.

D. 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 7329

CUTTING AND PATCHING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Requirements and limitations for cutting and patching of Work.

1.02 SUBMITTAL

A. Submit written request in advance of cutting or alteration which affects:

1. Structural integrity of any element of Project.
2. Integrity of weather-exposed or moisture-resistant element.
3. Efficiency, maintenance, or safety of any operational element.
4. Visual qualities of sight exposed elements.
5. Work of Owner or separate contractor.

B. Include in request:

1. Identification of Project.
2. Location and description of affected work.
3. Necessity for cutting or alteration.
4. Description of proposed work, and Products to be used.
5. Alternatives to cutting and patching.
6. Effect on work of Owner or separate contractor.
7. Written permission of affected separate contractor.
8. Date and time work will be executed.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Primary Products: Those required for original installation.

B. Substitutions: Under provisions of Section 01 2500.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.

B. After uncovering existing Work, inspect conditions affecting performance of work.

C. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.

B. Provide protection from elements for areas which may be exposed by uncovering work.

3.03 CUTTING AND PATCHING

A. Execute cutting, fitting, and patching to complete Work.

B. Fit Products together, to integrate with other work.

C. Uncover work to install ill-timed work.

D. Remove and replace defective or non-conforming work.

E. Remove samples of installed work for testing when requested.

F. Provide openings in the Work for penetration of mechanical and electrical work.

G. Cut rigid materials using saw or drill. Pneumatic tools are not allowed without prior approval.

H. Cut concrete or wall finish material at the nearest existing joints, but not less than area shown, unless noted otherwise.

3.04 PERFORMANCE

A. Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.

B. Employ skilled and experienced installer to perform cutting and patching.

C. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

D. Restore work with new Products in accordance with requirements of Contract Documents.

E. Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

F. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material, to full thickness of the penetrated element.

G. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

END OF SECTION

SECTION 01 7700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Closeout Procedures.

B. Final Cleaning.

C. Adjusting.

D. Demonstration and Instructions.

E. Project Record Documents.

F. Operation and Maintenance Data.

G. Warranties.

H. Spare Parts and Maintenance Materials.

1.02 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect's inspection.

B. Provide submittal to Architect that are required by governing or other authorities.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

D. Owner will occupy all of the building as specified in Section 01 1100.

1.03 FINAL CLEANING

A. Execute final cleaning prior to final inspection.

B. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Clean equipment and fixtures to a sanitary condition.

D. Replace filters of operating equipment.

E. Clean debris from roofs, gutters, downspouts, and drainage systems.

F. Clean site; sweep paved areas, rake clean landscaped surfaces.

G. Remove waste and surplus materials, rubbish, and construction facilities from the site.

H. Re-lamp all lighting fixtures.

1.04 ADJUSTING

A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.05 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products to Owner's personnel [two weeks] prior to date of final inspection.

B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

D. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at equipment location.

E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.06 PROJECT RECORD DOCUMENTS

A. Maintain on site, one set of the following record documents; record actual revisions to the Work in contrasting color.

1. Contract Drawings.

2. Specifications.

3. Addenda.

4. Change Orders and other Modifications to the Contract.

5. Reviewed shop drawings, product data, and samples.

B. Store Record Documents separate from documents used for construction.

C. Record information concurrent with construction progress.

D. Specifications: Legibly mark and record at each Product Section in contrasting color ink, description of actual Products installed, including the following:

1. Manufacturer's name and product model and number.

2. Changes made by Addenda and Modifications.

E. Contract Drawings and Shop Drawings: Legibly mark each item in contrasting color ink to record actual construction including:

1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.

3. Field changes of dimension and detail.

4. Details not on original Contract Drawings.

F. Submit documents to Architect for final Application for Payment.

1.07 OPERATION AND MAINTENANCE DATA

A. Provide data for:

1. Any architectural equipment, such as operable wall/ panel, video screen, electrical blinds, windows, etc

2. Mechanical / Plumbing Equipment and Controls.

3. Energy Management System.

4. Electrical System.

5. Kitchen Equipment.

6. Security System.

B. Submit two sets prior to final inspection, bound in 8-1/2 inch x 11 inch text pages, three ring D size binders with durable vinyl covers, and USB drive containing all pages of the identical documents.

C. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.

D. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with laminated plastic tabs.

E. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Engineers, Contractor, subcontractors, and major equipment suppliers.

F. Part 2: Operation and maintenance instructions, arranged by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:

1. Significant design criteria.

2. List of equipment.

3. Parts list for each component.

4. Operating instructions.

5. Maintenance instructions for equipment and systems.

6. Maintenance instructions for finishes, including recommended cleaning methods and materials.

G. Part 3: Project documents and certificates, including the following:

1. Shop drawings and product data.

2. Air and water balance reports.

3. Certificates.

4. Photocopies of warranties.

1.08 WARRANTIES

A. Provide duplicate notarized copies.

B. Each prime contractor is responsible for warranties related to his/her own contract.

C. Execute and assemble documents from Subcontractors, suppliers, and manufacturers.

D. Provide Table of Contents and assemble in binder with durable plastic cover.

E. Submit prior to final Application for Payment.

F. For Items of Work delayed beyond the date of Substantial Completion, provide updated submittal within ten (10) days after acceptance, listing date of acceptance as start of warranty period.

G. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of warranty on the work that incorporates the products.

H. Manufacturer's disclaimer and limitations on product warranties do not relieve suppliers, manufacturer's, and subcontractors required to countersign special warranties with Contractor.

I. When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

J. When work covered by warranty has failed and has been corrected, reinstate warranty by written endorsement. Reinstated warranty shall be equal to original warranty with equitable adjustment for depreciation.

K. Upon determination that Work covered by warranty has failed, replace or repair Work to an acceptable condition complying with requirements of the Contract Documents.

1.09 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.

B. Deliver to Project site and place in location as directed.

C. Obtain signed receipt for delivery of materials and submit prior to application for final payment.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 02 4116

DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Furnishing labor, materials and equipment necessary for demolition, dismantling, cutting and alterations as indicated, specified, or required for completion of the Work. Includes items such as the following:

1. Protection of existing improvements to remain.

2. Cleaning existing improvements to remain.

3. Disconnecting and capping utilities.

4. Removing debris, waste materials, and equipment.

5. Removal of items for performance of the Work.

6. Salvageable items to be retained by the Owner.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 01 1100 - Summary of Work.

4. Section 01 7329 - Cutting and Patching.

5. Division 26 –- Electrical.

1.02 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings indicating the extent of items and systems to be removed. Indicate items to be salvaged or items to be protected during demolition. Indicate locations of utility terminations and the extent of abandoned lines to be removed. Include details indicating methods and location of utility terminations.

1.03 QUALITY ASSURANCE

A. Perform the Work of this section by workers skilled in the demolition of buildings and structures. Perform the Work of this section under direct superintendence at all times.

B. Prior to commencement of Work, schedule a walkthrough with the Owner, to confirm Owner property items have been removed from scheduled Work areas. Identify and mark remaining property items and schedule their removal.

C. Coordinate demolition for the correct sequence, limits, and methods. Schedule demolition Work to create least possible inconvenience to the public and facility operations.

D. Related Standard: ANSI/ASSE A10.6.

1.04 PROJECT CONDITIONS

A. Drawings may not indicate in detail all demolition Work to be performed. Examine existing conditions to determine the full extent of required demolition.

B. Repair damage to existing improvements or damage due to excessive demolition.

C. Provide all measures to avoid excessive damage from inadequate or improper means and methods, improper shoring, bracing or support.

D. If conditions are encountered that varies from those indicated, promptly notify the Architect for clarification before proceeding.

PART 2 - PRODUCTS

2.01 HANDLING OF MATERIALS

A. Items scheduled for salvage by the Owner shall be delivered to a location designated by the Owner. Items shall be cleaned, packaged and labeled for storage.

B. Items scheduled for reuse shall be stored on the Project site and protected from damage, theft and other deleterious conditions.

PART 3 - EXECUTION

3.01 GENERAL

A. Protection:

1. Do not commence demolition until safety partitions, barricades, warning signs and other forms of protection are installed.

2. Provide safeguards, including warning signs, lights and barricades, for protection of workers, occupants, and the public.

B. If safety of existing construction appears to be endangered, take immediate measures to correct such conditions; cease operations and immediately notify the Owner.

3.02 DEMOLITION

A. Do not throw or drop materials. Furnish ramps or chutes as required by the Work.

B. Remove existing construction only to extent necessary for proper installation of Work and interfacing with existing construction. Cut back finished surfaces to straight, plumb or level lines as required for a smooth transition.

C. Where openings are cut oversize or in improper locations, replace or repair to required condition.

3.03 CUTTING EXISTING CONCRETE

A. Cutting of existing concrete shall be performed by skilled workers familiar with the requirements and space necessary for placing concrete. Perform concrete cutting with concrete cutting wheels and hand chisels. Do not damage concrete intended to remain.

B. Extent of cutting of structural concrete shall be as indicated on Drawings. Cutting of non-structural concrete shall be as indicated on Drawings or as reviewed by the Architect or structural engineer. Replace concrete demolished in excess of amounts indicated.

C. Prior to cutting or coring concrete, determine locations of hidden utilities or other existing improvements and provide necessary measures to protect them from damage.

3.04 REMOVAL OF EXISTING PLUMBING AND ELECTRICAL EQUIPMENT AND SERVICES

A. Remove existing plumbing and electrical equipment fixtures and services not indicated for reuse and not necessary for completion of the Work. Remove abandoned lines and cap unused portions of existing lines.

3.05 REMOVAL OF OTHER MATERIALS

A. Masonry: Cut back to joint lines and remove mortar without damaging units to remain. Allow space for repairs to backing where applicable.

B. Woodwork: Cut or remove to a joint or panel line.

C. Roofing: Remove as required, including accessory components such as insulation and flashings. At penetrations through existing roofing, trim cut edges back to sound roofing with openings restricted to the minimum size necessary to receive Work.

D. Sheet Metal: Remove back to joint, lap, or connection. Secure loose and unfastened ends or edges and provide a watertight condition. Re-seal as required.

E. Glass: Remove broken or damaged glass and clean rebates and stops of glazing channels.

F. Modular materials such as acoustical ceiling panels, resilient tile, or ceramic tile: Remove to a natural joint without leaving damaged or defective Work where joining new Work. After flooring removal, clean substrates to remove setting materials and adhesives.

G. Gypsum Board: Remove to a panel joint line on a stud or support line.

H. Plaster: Saw cut plaster on straight lines, leaving a minimum 2-inch width of firmly attached metal lath for installing new lath and plaster.

I. Remove existing improvements not specifically indicated or required but necessary to perform Work. Cut to clean lines, allowing for installation of Work.

3.06 PATCHING

A. Patch or repair materials to remain when damaged by the performance of the Work of this section. Finish material and appearance of patch and/or repair Work shall match existing.

3.07 CLEANING

A. Clean existing materials to remain with appropriate tools and equipment.

B. Protect existing improvements during cleaning operations.

C. Debris shall be dampened by fog water spray prior to transporting by truck.

D. Debris pick-up area shall be kept broom-clean and shall be washed daily with clean water.

E. Remove waste and debris, other than items to be salvaged. Turn over salvaged items to Owner, or store and protect for reuse where required. Continuously clean up and remove items as demolition Work progresses.

F. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Slab substrate.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments. Design mixtures shall be prepared by and signed and sealed by a Registered Civil Engineer.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Samples: For vapor retarder.

E. Qualification Data: For Installer.

F. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

a) Material Certificates: For each of the following, signed by manufacturers:

2. Cementitious materials.
3. Admixtures.
4. Form materials and form-release agents.
5. Steel reinforcement and accessories.
6. Granular fill.
7. Curing compounds.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Semirigid joint filler.
12. Joint-filler strips.
13. Repair materials.

G. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

H. Field quality-control test and inspection reports. (By I.O.R. and Testing Agency).

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5 and Section 7, "Lightweight Concrete."

2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

H. Mockups: Cast concrete slab-on-grade and formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.

1. Build panel approximately 200 sq. ft. (18.6 sq. m) for slab-on-grade and 100 sq. ft. (9.3 sq. m) for formed surface in the location indicated or, if not indicated, as directed by Architect.

2. Approved panels may become part of the completed Work if undisturbed at time of Substantial Completion.

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.

b. Independent testing agency responsible for concrete design mixtures.

c. Ready-mix concrete manufacturer.

d. Concrete subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints. Refer to Section 03 35 00 for form facing materials for colored architectural concrete.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    a. High-density overlay, Class 1 or better.
    b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
    c. Structural 1, B-B or better; mill oiled and edge sealed.
    d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.

2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.

3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Plain-Steel Wire: ASTM A 82, as drawn.

D. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.5 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type II, gray Supplement with the following:

a. Fly Ash: ASTM C 618, Class F.

b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Silica Fume: ASTM C 1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials. Use ASTM C227 to determine alkali reactivity of the aggregates as specified therein. The alkali reactivity shall be "innocuous" as determined by ASTM C289.

1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

2. Retarding Admixture: ASTM C 494/C 494M, Type B.

3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

C. Color Pigment: Refer to Section 03 35 00 Colored Architectural Concrete. Add other admixtures, such as integral waterproofing admixtures, if required.

2.7 GRANUALAR FILL

A. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, with 90 to 100 percent passing a ¾ sieve: 0 to 10 percent passing a No. 4 sieve; and 0 to 3 percent passing a No. 100 sieve.

B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.8 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet. USE FOR ALL FLATWORK, SLABS AND TOPPINGS.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. Products:

   a. Anti-Hydro International, Inc.; AH Clear Cure WB.

   b. Burke by Edoco; Spartan Cote WB II.

   c. ChemMasters; Safe-Cure & Seal 20.

   d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Cure and Seal WB.

   e. Dayton Superior Corporation; Safe Cure and Seal (J-18).

   f. Euclid Chemical Company (The); Aqua Cure VOX.

   g. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.

   h. Lambert Corporation; Glazecote Sealer-20.

   i. L&M Construction Chemicals, Inc.; Dress & Seal WB.

   j. Meadows, W. R., Inc.; Vocomp-20.

   k. Metalcrete Industries; Metcure.

   l. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 150E.

   m. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.

   n. Tamms Industries, Inc.; Clearseal WB 150.

   o. Unitex; Hydro Seal.

   p. US Mix Products Company; US Spec Hydrasheen 15 percent

2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Reglets: Fabricate reglets of not less than 0.0217-inch- (0.55-mm-) thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.

4. Compressive Strength: Not less than 4500 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.

4. Compressive Strength: Not less than 4500 psi at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 15 percent.

2. Combined Fly Ash and Pozzolan: 15 percent.

3. Comply with CBC Section 1903A.5.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture in concrete, as required, for placement and workability.

2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup. See Section 03 35 00 for other details.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: As indicated on the Drawings.

2. Maximum Water-Cementitious Materials Ratio: 0.60.

3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).

B. Foundation Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: As indicated on the Drawings.

2. Maximum Water-Cementitious Materials Ratio: 0.60.

3. Slump Limit: 5 inches (125 mm), plus or minus 1 inch (25 mm).

C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: As indicated on the Drawings.

2. Minimum Cementitious Materials Content: 610 lb/cu. yd. (320 kg/cu. m).

3. Maximum Water-Cementitious Materials Ratio: 0.45.

4. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.

2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).

3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.

2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.

2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 48 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.

2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

A. Comply with ACI 318 (ACI 318M) and ACI 301 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

B. Granular Course: Cover vapor retarder with fine-graded granular material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).

1. Place and compact a 1/2-inch- (13-mm-) thick layer of fine-graded granular material over granular fill.

3.6 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.

2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.

3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

5. Space vertical joints in walls practical. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover 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- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.

2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Maintain reinforcement in position on chairs during concrete placement.

3. Screed slab surfaces with a straightedge and strike off to correct elevations.

4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in 1 direction.

1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:

a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.

b. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

c. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.

d. Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.

3. Finish and measure surface with a dipstick measuring device by Face Construction Technologies or a F-meter measuring device by Allen Face & Company.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom. Coordinate finish with Section 093000 “Tiling”.

1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written

instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Water.

   b. Continuous water-fog spray.

   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Use only this method for slabs, concrete fill and toppings. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project..

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

   a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written

instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions. Refer to Section 033300 for other details.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.

2. Do not apply to concrete that is less than seven days old.

3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.14 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete, but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and

compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and

clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a resident inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

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SECTION 05 0513

HOT-DIP GALVANIZING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Hot-dip galvanizing of structural steel articles.
2. Preparation of galvanized steel assemblies for painting.

B. Related Sections:

1. Division 01 - General Requirements.
2. Section 05 5000: Metal Fabrications.
3. Section 09 9000: Painting and Coating.

1.02 REFERENCES

A. American Galvanizers Association (AGA):

1. Inspection of Products Hot-dip Galvanized after Fabrication.
2. The Design of Products to be Hot-dip Galvanized after Fabrication.
3. Recommended Details of Galvanized Structures.

B. ASTM International (ASTM):

1. ASTM A123 – Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
2. ASTM A143 – Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
3. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
4. ASTM A384 – Standard Practice for Safeguarding Against Warpage and Distortion during Hot-Dip Galvanizing of Steel Assemblies.
5. ASTM A385 – Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip).

6. ASTM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

7. ASTM B6 – Standard Specification for Zinc.

8. ASTM D6386 – Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.

9. ASTM D7803 - Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating.

10. ASTM E376 - Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Test Methods.

C. The Society for Protective Coatings (SSPC):

1. SSPC-SP1 – Solvent Cleaning.

2. SSPC-SP2 – Hand Tool Cleaning.

3. SSPC-SP3 – Power Tool Cleaning.

4. SSPC-SP5 – White Metal Blast Cleaning.

5. SSPC-SP7 – Brush-Off Blast Cleaning.

6. SSPC-SP10 – Near White Blast Cleaning.

7. SSPC-SP11 – Power Tool Cleaning to Bare Metal.

8. SSPC-SP16 - Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.

1.03 COORDINATION WITH STEEL FABRICATOR

A. Prior to fabrication, steel fabricators shall submit approved fabrication shop drawings to the galvanizer. The Galvanizer shall review fabricator shop drawings for suitability of materials for galvanizing and coatings and coordinate any required fabrication modifications.

B. Steel Fabricator shall notify the galvanizer of steel fabrications that exceed the ASTM A385 recommended percentages for carbon, phosphorus, manganese and silicon, so special galvanizing processing techniques are used.

C. Coordinate with steel fabricator appropriate marking and masking materials.

1.04 QUALITY ASSURANCE

A. Coating Applicator: Company specializing in hot-dip galvanizing after fabrication following the procedures in the Quality Assurance Manual of the American Galvanizers Association.

B. Galvanizer shall have an in-plant inspection program designed to maintain the coating thickness, finish, and appearance within the requirements of this Section.

1.05 SUBMITTALS

A. Galvanizing Certificate of Compliance: Provide notarized Certificate of Compliance with ASTM standards and specifications herein listed. The Certificate shall be signed by the galvanizer and contain a detailed description of the material processed. The Certificate shall include information as to the ASTM standard used for the coating.

1.06 DELIVERY, STORAGE AND HANDLING

A. Package and handle galvanized material in a manner which will avoid damage to the zinc coating.

B. Store in dry, well-ventilated conditions until shipping.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel for Galvanizing: As specified in Sections:

1. Section 05 1200: Structural Steel Framing.

2. Section 05 5000: Metal Fabrications.

3. Section 05 5100: Metal Stairs and Railings.

B. Zinc for Galvanizing: Conform to ASTM B6, as specified in ASTM A123.

PART 3 – EXECUTION

3.01 PREPARATION

A. Remove welding slag, splatter, anti-splatter compounds and burrs remaining in steel articles.

B. Provide drainage and venting holes in tubular assemblies. In thicker material drill holes in place of punching. Holes shall have a relatively uniform circumference. Punched holes or burned holes with a plasma torch shall be treated with a drill to even the diameter to appropriate size.

C. Masking installed by steel fabricator shall remain in place through galvanizing process completion.

D. Provide lifting lugs to allow for handling during galvanizing. Avoid the use of chains or wires directly connected to steel articles.

E. Safeguard against warpage or distortion of steel members in accordance with ASTM A384.

F. Pre-clean steel work in accordance with accepted methods to produce an acceptable surface for quality hot-dip galvanizing. Remove surface contaminants and coatings that are not removable by the normal chemical cleaning process in the galvanizing operation by grit-blasting, sand-blasting, or other mechanical means.

G. Follow the degreasing, pickling and fluxing steps to remove remaining oxides and to deposit a protective layer on the steel to prevent any further oxides from forming on the surface prior to immersion in the molten zinc.

3.02 COATING APPLICATION

A. Galvanize steel articles, fabrications and assemblies by the hot-dip process in accordance with ASTM A123. The bath chemistry shall be as specified by ASTM B6, and requires at least 98% pure zinc maintained at approximately 840 F.

B. Galvanize bolts, nuts, washers and iron and steel hardware components in accordance with ASTM A153.

C. Safeguard products against steel embrittlement in conformance with ASTM A143.

D. Once the fabricated items' coating growth is complete, withdraw slowly from the galvanizing bath, and remove the excess zinc by draining, vibrating, and/or centrifuging.

E. Prepare galvanized products for powder coating in accordance to ASTM D7803. Prepare galvanized products for painting in accordance to ASTM D6386.

F. Handle articles to be galvanized in such a manner as to avoid mechanical damage and to minimize distortion.

G. Apply a chromate passivation treatment to fabrications that will not be painted after galvanizing to minimize the wet storage staining which may occur on articles unable to be stored in dry, well-ventilated conditions.

3.03 COATING REQUIREMENTS

A. Conform to paragraph 6.1 of ASTM A123, or Table 1 of ASTM A153, as applicable.

B. Surface Finish: Continuous, adherent, as smooth and evenly distributed as possible and free from any defect detrimental to the stated end use of the coated article

C. Adhesion: Withstand normal handling consistent with the nature and thickness of the coating and normal use of the article.

3.04 TESTS

A. Inspection and testing of hot-dip galvanized coatings shall be done under the guidelines provided in the AGA publication Inspection of Products Hot-dip

Galvanized after Fabrication. Tests and inspections shall be performed immediately after the coating is applied and has cooled to ambient temperature, and before it leaves the galvanizing facility.

B. Include visual examination and test methods in accordance with ASTM A123, or A153, as applicable, to determine the thickness of the zinc coating on the metal surface.

C. During the visual inspection, if adhesion concerns are suspected, such as peeling or flaking of the galvanized coating, then adhesion testing using the stout knife method shall be conducted. Embrittlement testing is required when there is evidence of embrittlement and shall be conducted per the requirements of ASTM A143.

D. Upon completion of tests furnish notarized Certificate of Compliance with ASTM standards and specifications herein listed.

3.05 REPAIR OF DAMAGED COATINGS

A. Smooth out rough surfaces, bumpy or high spots and icicles by hand filing or power sanding the area without removing any more zinc coating than necessary. Repair damaged galvanized surface with a zinc rich coating.

B. Repair areas damaged during galvanizing process or handling by one of the approved methods in accordance with ASTM A780 whenever damage exceeds 3/16” in width. Minimum thickness requirements for the repair shall be per ASTM A123, Section 6.2.

C. Remove lifting lugs and repair coating with a zinc rich coating.

D. Surface preparation for application of zinc rich coating shall be in accordance to ASTM A780.

1. Clean areas in accordance to SSPC-SP2.

2. Prepare surface for zinc spray in accordance to SSPC-SP5, or zinc rich paint repair in accordance to SSPC-SP10.

3.06 PREPARATION FOR TOP COATING

A. Galvanized fabrications indicated on the drawings to be painted shall be prepared in accordance to ASTM D6836.

1. Surface cleaning prior to surface preparation in accordance to SSPC-SP1.

2. Removal of zinc high spots and cleaning of light deposits of zinc reaction products in accordance to SSPC-SP2 or SSPC-SP3.

3. Profile surface in accordance to SSPC-SP7 or SSPC-SP11.

B. Galvanized fabrications indicated on the drawings to be powder coated shall be prepared in accordance to ASTM D7803.

1. Surface cleaning and removal of oil and grease in accordance to SSPC-1.

2. Surface smoothing and removal of loose particles in accordance to SSPC-SP-2 or SSPC-SP3.

3. Sweep blasting and surface profiling in accordance to SSPC-SP16.

END OF SECTION

SECTION 05 5000

METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Metal fabrications:

1. Steel framing and supports for mechanical and electrical equipment.

2. Steel supports for coiling doors.

3. Miscellaneous steel framing, supporting angles, plates, brackets, clips, anchors and bolts for equipment, and other work which is not specifically included in Section 05 1200, Structural Steel Framing.

4. Miscellaneous fabrications, as indicated on the Drawings.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 01 4523: Testing and Inspection.

3. Section 03 3000 – Cast-in-Place Concrete.

4. Section 05 5013: Hot-Dip Galvanizing.

1.02 REFERENCES

A. ASTM International (ASTM):

1. ASTM A27 – Standard Specification for Steel Castings, Carbon, for General Application.

2. ASTM A36 – Standard Specification for Carbon Structural Steel.

3. ASTM A47 - Standard Specification for Ferritic Malleable Iron Castings.

4. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

5. ASTM A123 - Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.

6. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

7. ASTM A283 - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

8. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

9. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

10. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

11. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.

12. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

13. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

14. ASTM D1187 - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

15. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

16. ASTM F2329 - Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.

B. American Welding Society (AWS):

1. AWS D1.1 Structural Welding Code - Steel.

2. AWS D1.3 Structural Welding Code - Sheet Steel.

3. AWS D-19.0 Welding Zinc Coated Steel.

1.03 COORDINATION

A. Coordination between Steel Fabricator and Galvanizer:

1. Prior to fabrication, submit approved fabrication shop drawings to the galvanizer.

2. Notify galvanizer of steel fabrications that exceed the ASTM A385 recommended percentages for carbon, phosphorus, manganese and silicon, so special galvanizing processing techniques are used.

B. Coordinate installation of metal fabrications that are anchored to concrete or masonry, or that receive work specified by other Sections. 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.

C. Field Measurements: Field verify dimensions prior to fabrication.

D. Coordinate selection of shop primers with galvanizing, and with paintings to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and paintings are compatible with one another.

1.04 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings indicating provided materials, dimensions, anchoring detail, and details of termination or connection to adjacent construction. Indicate items that are purchased from a manufacturer and items that are shop fabricated. Indicate component parts requiring Project site fabrication or assembly.

B. Product Data: Submit Product Data for manufactured items. Submit Product Data for primers and finishes.

C. Material Samples: Submit Samples of primers and finishes on fabricated items.

D. Fabricator qualifications per Article “Quality Assurance”.

E. Welding:

1. Welder’s Certificates: Field welders shall be Project certified in accordance with AWS D1.1.

2. Welding Material Certification: Provide certificate that welding material complies with specifications.

F. Research/Evaluation Reports: ICC-ES for post-installed anchors.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm with a minimum five year experience in successfully producing metal fabrications similar to that shown on the drawings.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D-1.1– Structural Welding Code – Steel.

2. AWS D1.3 - Structural Welding Code - Sheet Steel.

C. Inspection of Welding: Refer to Section 01 4523: Testing and Inspection.

D. Field applied primers, paintings, sealers and adhesives shall be approved by the OWNER’s Office of Environmental Health and Safety (OEHS).

E. Preassemble items in shop to greatest extent possible to minimize field welding. Mark units for reassembly and coordination of installation. Use marking method compatible with galvanizing.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store miscellaneous metal items above grade on platforms, skids, or other required supports.

B. Protect from damage and from corrosion, dirt, grease and other foreign matter.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Structural Steel Shapes: ASTM A36.

B. Rolled Steel Plates: ASTM A36. Plates to be bent or cold-formed shall conform to ASTM A283, Grade C.

C. Round HSS: ASTM A500 Grade B or C.

D. Square and Rectangular HSS: ASTM A500 Grade B or C.

E. Steel Pipe: ASTM A53 Type E or S, Grade B, standard weight (Schedule 40), unless otherwise noted. Black finish.

F. Steel Sheet: ASTM A1008 or ASTM A1011.

G. Steel Bolts: ASTM A307, Grade A, or F3125 with hex steel nuts per ASTM A563 and washers. Galvanized in accordance with ASTM A153 for exterior locations.

H. Steel Bars: Conforming to ASTM A108 or ASTM A575.

I. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47, or cast steel, ASTM A27. Provide bolts, washers, and shims, hot-dip galvanized per ASTM A153.

J. 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.

K. Concrete Materials:

1. Concrete per Section 03 3000, Cast-in-Place Concrete.

2. Welded wire fabric and reinforcing per section 03 2000, Concrete Reinforcing.

2.02 FABRICATION

A. General:

1. Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces. Mark units for reassembly and installation.

2. Cut, drill, and punch metals cleanly and accurately. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated or specified. Remove sharp and rough areas on exposed surfaces. Form exposed work with accurate angles and surfaces and straight edges. Form exposed connections with hairline joints, flush and smooth. Locate joints where least conspicuous.

B. Welding:

1. Weld connections unless otherwise indicated.

2. Weld corners and seams continuously and in accordance with requirements of AWS D1.1 Structural Welding Code. Welds shall be inspected as required in Section 05 1200: Structural Steel Framing.

3. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

2.03 PREPARATION FOR GALVANIZING

A. Fabricate to the largest size possible and whenever possible use slip joints to minimize field welding.

B. Fabricate structural steel in accordance with Class I, II, III guidelines as described in AGA's Recommended Details for Galvanized Structures, to facilitate galvanizing process. Corners of gussets, stiffeners, and bracing shall be cropped to allow free flow of zinc during galvanizing process.

C. Remove welding slag, splatter, anti-splatter compounds and burrs prior to delivery for galvanizing.

D. Marking for Identification: Avoid unsuitable marking paints for identification, such as oil based paints and markers and crayon markers. Use water soluble paints or markers acceptable to galvanizer or steel tags wired to the work.

E. Masking: Use masking materials recommended by the American Galvanizers Association (AGA) to produce ungalvanized areas for field welding and at slip critical bolts.

F. Galvanize fabrications per Section 05 5013, Hot-Dip Galvanizing, in accordance with ASTM A123 and ASTM A153.

2.04 SHOP FINISH

A. Metal fabrications shall be provided with a coat of primer, except those indicated to be hot-dip galvanized.

B. Primers:

1. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

2. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

3. Minimum dry film thickness of primer shall be 2.0 mils.

C. Preparation for Primer Painting: Miscellaneous ferrous metal, except items specified galvanized, shall be thoroughly cleaned and prepared for painting, including removal of shipping oils or protective coatings, mill scale, grease, dirt and rust. Prepare in accordance with SSPC recommendations. Deliver to Project site primed or galvanized as indicated, and ready to receive Project site applied finishes.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the areas where metal fabrications are to be installed. Notify the OAR in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Provide anchorage devices and fasteners as indicated in the drawings and where necessary for securing miscellaneous metal fabrications to in-place construction.

B. Cut, drill, and fit as required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. 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 the surfaces of hot-dip galvanized fabrications intended for bolted or screwed field connections.

D. Alignment: Verify alignment of items with adjacent construction. Coordinate related work.

E. Grout: Follow manufacturer's recommendations for substrate preparation and application.

F. Corrosion Protection: Coat concealed surfaces of metals that will come into contact with grout, concrete, masonry, or wood, with a heavy coat of bituminous paint or zinc chromate primer. Protect dissimilar metals from galvanic corrosion by pressure tapes, coating, or isolators.

3.03 FIELD WELDING

A. Preparation of Weld Area of Galvanized Fabrications: Remove masking from fabrications. Remove remaining zinc coating between one inch and four inches from both sides of members to be welded, by grinding back the zinc coating, burning the zinc away or pushing back the molten zinc from the weld area.

B. Welding: Comply with AWS Code for procedures of manual shielded metal-arch welding, appearance and quality of welds made, methods used in correcting welding work.

1. Weld in accordance to AWS D-1.1.

2. Weld galvanized fabrications in accordance to AWS D-19.0.

C. Remove welding flux immediately. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surfaces matches those adjacent.

D. Upon completion of welding plug vent, drainage and lifting holes of galvanized fabrications with appropriate diameter zinc plugs. Push in about half way by hand, and hammer to a tight fit. With a hand file or an abrasive tool, file away excess material. Repair scratches with a zinc rich coating.

1. Plug railing holes.

2. Plug visible holes of HSS members.

3.04 ADJUSTING AND CLEANING

A. Touch Up Damaged Surfaces:

1. Shop Painted Finishes: Comply with SSPC-PA-1 for touch-up; apply with brush to produce a minimum 2.0 mil dry film thickness.

2. Galvanized Surfaces: Clean field welds, connections and damaged areas. Apply two coats of Carbomastic 15, by Carboline or equal product approved by OWNER’s OEHS. Brush or roll to a 4 to 6 mil thickness.

3.05 CLEAN UP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.06 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Rooftop equipment bases and support curbs.
4. Wood blocking, cants, and nailers.
5. Wood furring and grounds.
6. Wood sleepers.
7. Plywood backing panels.

1.2 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1. Include data for wood-preservative and fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee Board of Review.

C. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Engineered wood products.
4. Power-driven fasteners.
5. Powder-actuated fasteners.
6. Expansion anchors.
7. Metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Provide dressed lumber, S4S, unless otherwise indicated.

B. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium].

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2. Wood sills, sleepers, blocking, [furring,] [stripping,] and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 DIMENSION LUMBER FRAMING

A. Maximum Moisture Content: 19 percent.

B. Non-Load-Bearing Interior Partitions: Douglas Fir No. 2 or better.

C. Framing Other Than Non-Load-Bearing Interior Partitions: Douglas Fir No. 1.

D. Exposed Framing Indicated to Receive a Stained or Natural Finish: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
1. Species and Grade: Douglas fir-larch; Select Structural WCLIB, or WWPA.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Douglas Fir, No. 2 grade or better.

2.5 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exterior, C-C Plugged fire-retardant treated as required, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel.

B. Power-Driven Fasteners: NES NER-272.

C. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

2.7 METAL FRAMING ANCHORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products indicated on Drawings.

C. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated on Drawings.

D. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those [indicated] [of basis-of-design products] [of products of manufacturers listed]. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

E. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

2.8 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.

B. Flexible Flashing: Self-adhesive, rubberized-asphalt compound, bonded to a high-density, polyethylene film to produce an overall thickness of not less than 0.025 inch (0.6 mm).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

C. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

D. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

E. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions and ICC ESR reports.

F. Do not splice structural members between supports, unless otherwise indicated.

G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. ICC ESR-1663 for power-driven fasteners.
2. Table 2304.10.1, "Fastening Schedule," in California Building Code.

3.2 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 06 1643

GYPSUM SHEATHING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Fiberglass-mat faced, moisture and mold resistant exterior gypsum sheathing.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 06 1000 - Rough Carpentry.

3. Section 07 2100 Thermal Insulation.

4. Section 07 9200 - Joint Sealants.

1.02 PROJECT REQUIREMENTS

A. Design Requirements: Provide systems capable of resisting deflection.

B. Regulatory Requirements: Comply with CBC requirements for design and installation.

1.03 SUBMITTALS

A. Material Samples: Submit 5.5” inch by 8.5” inch sample of the exterior sheathing panel. Submit 5 screws to be utilized in attaching the exterior sheathing panel.

B. Product Data: Submit manufacturer's catalog data for the sheathing product and the attachment screws.

1.04 QUALITY ASSURANCE

A. Comply with following as a minimum requirement:

1. ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

2. ASTM C1177 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

3. ASTM C1280 Standard Specification for Application of Gypsum Sheathing.

4. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials.

5. Gypsum Association (GA): GA-253 Application of Gypsum Sheathing.

B. Qualifications: Installer shall have a minimum 5 years experience in installing and finishing gypsum board.

A. CHPS Low-Emitting Materials table: Materials submitted shall meet the CHPS Low-Emitting criteria and be listed as Low-Emitting on the following web site: www.CHPS.net or be listed on UL website Greenguard.org as Greenguard Gold Certified.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, factory sealed packages, containers or bundles bearing brand name and name of manufacturer.

B. Materials shall be kept dry. Exterior Sheathing shall be neatly stacked flat; avoid sagging and damage to edges, ends, and surfaces.

C. Fire-rated materials shall have fire classifications numbers attached and legible.

D. Provide all means necessary to protect Exterior Sheathing systems before, during, and after installation.

E. Exterior sheathing showing any evidence of water damage shall not be installed. Exterior sheathing showing evidence of water damage after installation shall be removed and replaced.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS AND PRODUCTS

A. Georgia-Pacific - Dens Glass Gold sheathing.

B. National Gypsum Co. - Gold Bond eXP sheathing.

C. U.S. Gypsum Co. - SECUROCK brand UltraLight glass Mat.

D. Or equal.

2.02 MATERIALS

A. Exterior sheathing Type X (fire-resistant): 5/8 inch thick, 4-foot wide and up to 10 feet long conforming to ASTM C1177.

1. Edges: Square.

2. Surfacing: Fiberglass mat on face, back, and long edges.

3. Mold Resistance: score of 10 per ASTM D3273 in a test as manufactured.

2.03 ACCESSORIES

A. Fasteners: ASTM C1002, corrosion resistance of more than 800 hours per ASTM B117. In coastal environments or aggressive environments, stainless steel fasteners shall be used.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install in accordance with the fire rated assembly indicated on the drawings, GA-253, ASTM C1280 and the manufacturer's recommendations.

B. Prior to application of exterior system, attachment of sheathing to framing shall be able to withstand design wind loads of building.

3.06 CLEAN-UP

A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

3.07 PROTECTION

A. Protect Work of this section until Substantial Completion.

END OF SECTION

SECTION 07 2100

THERMAL INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Thermal batt insulation for exterior walls and under roof decks.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 09 2216 - Non-Structural Metal Framing.

3. Section 09 2423 – Cement Plaster and Metal Lath.

1.02 SUBMITTALS

A. Product Data:

1. Material List: Provide a list of materials for installation under this section.

2. Provide manufacturer's printed Product Data for each type insulation and accessory.

B. Manufacturer's Instructions: Submit manufacturer's printed installation instructions.

C. Certification: Provide certification that insulation materials conform to requirements of CBC Chapter 26.

D. Recycled Content: Provide certification that insulation materials contain a minimum 30 percent recycled materials.

1.03 QUALITY ASSURANCE

A. Surface Burning Characteristics: Flame spread rating shall not exceed 25 and smoke density shall not exceed 450 when tested in accordance with ASTM E84.

B. Combustion Characteristics: Rated as non-combustible when tested in accordance with ASTM E136.

C. Comply with following as a minimum requirement:

1. ASTM C209 – Standard Test Methods for Cellulosic Fiber Insulating Board.

2. ASTM C553: Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

3. ASTM C578: Specification for Rigid, Cellular Polystyrene Thermal Insulation.

4. ASTM C1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.

5. ASTM D1621 – Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

6. ASTM D1622 – Standard Test Method for Apparent Density of Rigid Cellular Plastics.

7. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

8. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C.

9. NFPA 285 – Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

D. CHP Low-Emitting Materials Table: Materials submitted for building insulation must be listed as low emitting on the CHPS website, www.CHPS.net, or must be tested by an independent laboratory to meet CHPS requirements. Components of an assembly must meet CHPS requirements individually or in an assembly.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Project site and store in a safe, dry place, with labels intact and legible at time of installation.

B. Protect building insulation materials from damage.

1.05 PROJECT CONDITIONS

A. Avoid exposure to humidity and moisture. Protect from exposure to sunlight.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Owens Corning.

B. Johns Manville.

C. CertainTeed Corporation.

D. DuPont.

E. DiversiFoam Products.

F. Atlas Roofing Corporation

G. Equal.

2.02 MINERAL FIBER BATT INSULATION

A. Unfaced Glass Fiber Batt Insulation: Provide friction-fit, unfaced glass fiber batts. Insulation shall consist of glass fibers, glass or slag, and thermosetting resins complying with ASTM C665, Type I.

B. Foil Faced Glass Fiber Batt Insulation: Provide glass fiber batts with vapor barrier consisting of glass fibers, glass or slag, and thermosetting resins complying with ASTM C665, Type III, Class A, Category 1 with vapor-retardant membrane facing.

C. Fasteners for Attaching Insulation to Wood Framing:

1. For faced batt insulation provide one of following types of staples: Stainless steel, monel, or copper-coated steel, size as required by manufacturer or applicable code.

2. For unfaced batt insulation provide 18 gage, minimum, galvanized steel wire where required to maintain proper insulation placement.

D. Fasteners for Attaching Insulation to Underside of Metal Roof Decks:

1. Spindle Anchors: Stic-Klip Mfg. Co., Type A or B as required, with Type S adhesive; Miracle Adhesives Corp. "Miracle StukUps" with Type HT994 adhesive; or Goodloe E. Moore Gemco or Tuff-Weld with G-P Improved or Tuff-Bond Quik-Set Type Adhesive as applicable; or equal. Provide adhesives of correct type for substrates and type of anchor.

2. String Wires: Minimum 18 gage galvanized steel wire.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine Work to verify suitability to receive insulation. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General:

1. Fit polyisocyanurate or batt insulation, of R-value indicated on Drawings, snugly between framing members.

2. Maintain total insulation integrity over entire area to be insulated, including areas between closely spaced members.

3. Extend full thickness insulation over entire area to be insulated. Furnish manufacturer's recommended clips to tightly fit batts at joints.

4. Cut and fit batt insulation tightly around pipes, conduits and penetrations.

5. Do not compress batt insulation in excess of 10 percent (R-19 may be installed in 2 by 6 stud walls).

6. Prevent batt insulation from sagging during and after installation by installing adequate wire.

7. Metal door and window frames in acoustically insulated walls shall be filled with insulation, unless otherwise indicated.

8. Where vapor barrier is provided, install with vapor barrier facing room.

a. Batts in Metal Framing: Provide friction-fit batts tightly fitted to stud webs and to metal furring.

b. Batts under Metal Roof Decks where underside of insulation will be exposed install foil-faced flanged-type insulation batts and staple flanges together at maximum 4-inch centers and seal joints at abutting vertical surfaces with a pressure-sensitive plastic tape. Where underside of insulation will be inaccessible, install secure with spindle anchors. Provide 18 gage galvanized string wires under batts wherever necessary to prevent sagging. Stretch wire taut.

c. Batts in Horizontal or Sloped Applications: Provide tightly stretched string wires along center of horizontal or sloping batts where support spacing exceed 16 inch on centers.

d. Batts in Ceiling Framing: Install batts between joists, so top of insulation is level with top of framing members. Do not install insulation over recessed lighting fixtures, speakers, or other heat producing elements in ceilings. At junction boxes, access panels, and other items requiring

access from above or below ceiling, cut insulation on each side to fit item and install loosely on top. Fit insulation snugly around ducts, conduits, pipes, and other items projecting through ceiling construction.

9. Install polyisocyanurate board as required by Section 07 1326.

B. Continuous Insulation:

1. Continuous insulation shall be installed in accordance with manufacturer instructions. Fasten the insulation board to the exterior face of the steel stud wall framing using preassembled screw/stress plate fasteners, of type and length as recommended by the manufacturer. Fastener pacing shall be 12" on center at the board perimeter and 16" on center in the field of the board.

2. Bottom row of insulation panels shall be mounted on foundation casing "J" mold, refer to Section 09 2423, Cement Plaster and Metal Lath. Fasten insulation boards with corrosion resistant fasteners through sheathing into studs. Use 3/8 inch head roofing nails for wood studs, and self-drilling tapping screws for metal studs, or to "Z" channels, as applicable. Fastener penetration into studs shall be not less than 3/4 inch.

3. Stagger vertical joints at least one stud from adjacent courses.

3.03 PROTECTION

A. Protect Work of this section until Substantial Completion.

3.04 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off project site.

END OF SECTION

SECTION 07 6000

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Miscellaneous metal flashing and counter flashing as required, except where provided under Divisions 22, Plumbing, 23, HVAC, or 26, Electrical.
2. Drip flashings.
3. Sheet metal wall coverings.
4. Other sheet metal items not necessarily specified herein or in other sections but required to prevent penetration of water into building.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 07 9200 - Joint Sealants.
3. Section 08 3323 – Overhead Coiling doors and Grilles.
4. Section 09 2423 - Cement Plaster and Metal Lath
5. Division 22 –- Plumbing.
6. Division 23 - HVAC.
7. Division 26 - Electrical.

1.02 SUBMITTALS

A. Shop Drawings: Submit for fabricated sheet metal indicating shapes, details, methods of joining, anchoring and fastening, thicknesses and gages of metals, concealed reinforcement, expansion joint details, sections, and profiles.

B. Samples: Submit Samples for materials or assemblies as requested.

C. Product Data: Submit brochures of manufactured items.

1.03 QUALITY ASSURANCE

A. Drawings and requirements specified govern. Provide the Work of this section in conformance with the Architectural Sheet Metal Manual published by SMACNA for conditions not indicated or specified and for general fabrication of sheet metal items.

B. Materials shall conform to following standards:

1. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
2. ASTM A653 - Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

3. ASTM B370 - Copper Sheet and Strip for Building Construction.

C. Pre-installation Meetings: Refer to Division 07 roofing sections as appropriate. Attend the pre-installation and inspection meetings for roofing Work.

1.04 DELIVERY, STORAGE AND HANDLING

A. Do not install bent or otherwise damaged materials.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Galvanized Sheet Steel: ASTM A653, coating designation G90, hot-dip galvanized.

B. Copper Plate, Sheet and Strip: ASTM B370, cold-rolled, tempered. Copper sheet and strip shall be cold-rolled-temper.

C. Stainless Steel: Plate, sheet and strip shall conform to ASTM A167, Type 304 or Type 316, No. 4 finish on exposed surfaces and No. 2 finish on concealed surfaces unless otherwise specified or indicated. Furnish Type 304 for general applications and Type 316 where exposed to acidic or alkaline conditions.

D. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

E. Fastenings:

1. Galvanized Steel: Nails, rivets, and other fastenings furnished in connection with galvanized sheet steel Work shall be sealed with rust resistive coating. Rivets shall be tinned. Nails and other fastenings shall be zinc-coated.

2. Copper: Nails, rivets, and other fastenings furnished in connection with copper sheet metal Work, shall be manufactured from hard-temper copper or hard brass.

3. Stainless Steel: Nails, rivets and other fastenings furnished in connection with stainless steel Work, shall be 300 series alloy to match alloy of stainless steel being fastened.

F. Soldering Flux: Raw muriatic acid for galvanized steel; rosin for tin, and tinned copper; non-corrosive soldering salts for uncoated copper and acid-type flux formulated for soldering stainless steel.

G. Solder: ASTM B32, Grade 5A, composed of 95-5 tin-antimony. Name of product manufacturer and grade designation shall be labeled, stamped or cast onto each coil or bar.

2.02 FABRICATION

A. General:

1. Accurately form sheet metal Work to dimensions and shapes indicated and required. Cope finish molded and brake metal shapes with true, straight, sharp lines and angles and, where intersecting each other, to a precise fit. Unless

otherwise specified, all galvanized sheet steel shall be 22 gage. Exposed edges of sheet metal shall have a ½ inch minimum hemmed edge.

2. Soldering of sheet steel or copper shall be performed with well-heated copper soldering iron or soldering torch, joints full flowing, neat and consistent. Fill joint completely with solder. Clean materials at joints before soldering, and tin coppers before soldering. Exposed soldering on finished surfaces shall be scraped smooth. Lock seam work shall be fabricated flat and true to line and soldered along its entire length. Acid-fluxed Work shall be neutralized after fabrication.

3. Form and install sheet metal Work to provide proper allowances for expansion and contraction, without causing undue stresses in any part of completed Work. Installation shall be water and weathertight.

B. Gutters and Downspouts:

1. Gutters: Fabricate from 22 gage galvanized steel to match existing size and design unless otherwise indicated. Maximum length of gutter shall be 40 feet between end or expansion joints unless the system is specially designed to accommodate the greater expansion, the larger flow and the need for special supports. Drain gutter towards nearest downspout and provide an expansion joint at mid-point between downspout outlets, but not to exceed 40 feet on center. Gutters shall not pond water. Rivet joints and ends with a minimum of 6 rivets per joint or maximum rivet spacing not to exceed 1 ½-inch on center and ½ inch from the edge of the metal, consisting of 3-inch overlap. Sweat solder from inside of gutter and in horizontal position where possible. Neatly fit downspouts to gutter using a slip joint. Provide expansion joints, consisting of 3-inch lap joints at not over feet.

2. Form and install sheet metal Work to provide allowance for expansion and contraction without causing undue stresses in the completed Work.

3. Downspouts: Fabricate downspouts from 3-inch round, or 3-inch by 4-inch rectangular shapes, 16 gage steel tubing with butt joints and mitered elbows, sized as indicated. Downspouts shall be constructed with conductor heads every 40 feet to admit air and prevent vacuum. Keep downspouts offsets to a maximum of 10 feet. Downspout shall be fabricated with elbows at bottom discharge or connected to drains as indicated. Joints, except expansion joints shall be sealed with a continuous weld. Galvanize downspouts after fabrication.

4. Outlets: Fabricate outlets of 22 gage galvanized sheet steel with a 1/4 inch rolled flanged soldered continuously to gutter. Outside diameter shall be 1/8 inch less than the inside diameter of the downspout and extend into downspout 4 inches. Install a removable wire “bulb type” strainer to outlet opening. Strainer shall be fabricated of 22 gage galvanized steel and ½ inch hardware cloth.

C. Conductor Heads: Fabricate conductor heads and outlets from 22 gage galvanized sheet steel. Cover tops of the conductor heads with 22 gage galvanized ¼ inch wire mesh soldered securely to separately fabricated frame and mechanically fastened to top conductor head with a minimum of two fasteners.

D. Gravel Stops: Provide 24 gage galvanized sheet steel gravel stops wherever roof area drops to a lower level; at the eaves and rake of roof, where roof comes to an abrupt edge, and where indicated. Stops shall be of height indicated and shall be fabricated with two flanges. Horizontal flange shall be not less than 4 inches wide, and vertical flange shall extend down over vertical surfaces of trim or gutter. Gravel stops shall lap 4 inches at ends and corners and shall be fabricated by notching and interlocking vertical face flanges. Contact surfaces of lapped flanges, including raised areas, vertical face and corners, shall be completely covered with flashing compound. Fabricate lap joints so that they will be in the direction of water flow. Where flanges are over five inches wide, provide 20 gage continuous cleats fastened at 24 inches on center.

E. Overflow Outlets: Provide galvanized sheet steel overflow outlets at locations and of sizes indicated. Outlets shall extend through full thickness of wall in one continuous piece and completely line the opening. On outside face of wall, top and sides of outlet shall finish 1/2 inch on surface of wall. Bottom of outlet shall project 1 ½ inches beyond face of wall and shall be bent down slightly. Outlets shall be sealed on the surface of the building. On inside face, side and bottom flanges shall extend not less than 8 inches beyond edge of opening, and not less than 6 inches at top. Outlets shall be installed at time roof is being installed.

F. Reglet Type Counterflashing: Where roof comes in contact with vertical surfaces, provide counterflashing. Set top of counter flashing 8 inches above roof deck unless otherwise indicated and extend down at least 5 inches or to top of cant strip. Counterflashing and reglet shall be 22 gage galvanized sheet steel. Lap counter flashing and reglet 3 inches minimum at splices and miter at angles or supply special metal corner fittings. Reglet and method of securing flashing shall be so constructed that flashing is firmly locked in place but may be readily removed for replacement.

G. Splash Pans: Provide splash pans for all downspouts, which empty onto lower roofs. Pans shall be galvanized sheet steel 12-inch by 18-inch, unless otherwise indicated, and turned up 2 inches on at least three sides.

H. Roof Expansion Joint Covers: Fabricate of 22 gage galvanized sheet steel, as detailed. One side of joint shall be zee shaped, with 3-inch standing leg extended over the joint and turned down. The other side shall be box shaped, fabricated to extend over the joint, over the standing leg, and turn down to form a water barrier. Prefabricated bellows type joint covers are not permitted.

I. Miscellaneous Flashing: Unless otherwise indicated, miscellaneous flashing shall be fabricated of galvanized steel. Exterior doors and windows, unless covered by overhangs shall be provided with 22 gage galvanized steel drip flashing as detailed. At wood construction, nail flashing to framing before paper backed lath is installed.

J. Roof Pipe Flashings:

1. PVC roofs: provide PVC flashings or prefabricated welded or seamless flashings.

2. Tile and built up roofs: provide 24 gage galvanized steel flashings with a storm worker.

PART 3 - EXECUTION

3.01 PREPARATION

A. Concrete and masonry materials in contact with sheet metal shall be painted with alkali resistant coating, such as heavy-bodied bituminous paint. Wood in contact with sheet metal shall be painted with two coats of aluminum paint or one coat of heavy-bodied bituminous paint.

3.02 INSTALLATION

A. General: Coordinate with installation of underlayment indicated in the Drawings and specified in Section 09 2423.

B. Gutters and Downspouts:

1. Anchor gutters to structure with 10 gage steel straps, galvanized after fabricating. Secure straps with galvanized fasteners at 3 feet on center. Drill pilot holes and use 12 by 2-inch pan head screws.

2. Install 1/4 inch galvanized wire mesh continuous cover on gutter.

3. Secure downspouts to walls with 1/8 inch by 2-inch galvanized steel straps. Straps shall be located at top, bottom, and at not over 10 feet on center. Block downspouts out ½ inch from the finish wall surfaces and 1 inch from the bottom of downspout grade. Secure straps to wall framing with 1/4 inch by 2-inch long galvanized anchors. Expansion type anchors shall be provided when anchoring to concrete and masonry. Provide toggle bolts for attachment to masonry or plaster. At steel columns, provide fasteners as indicated. Plastic anchors are not permitted.

4. Anchor conductor heads to walls with 1/4 inch diameter by 2 ½-inch long galvanized lag screws or 1/4 inch expansion type anchors.

C. Reglets: Install reglets at constant height above cant or as indicated. Provide minimum 3-inch lap at end splices of reglets. Seal laps watertight.

D. Counterflashing:

1. Install at constant horizontal elevation across roof slope and slope at constant height above cant or as indicated.

2. Provide minimum 3-inch lap at all end splices of counterflashing.

E. Galvanized sheet steel parapet coping and flashing shall be continuous over top of parapet to form a watertight cap, with waterproof seams at approximately 10 feet on center, or as indicated. Anchor coping to outside of wall with a continuous cleat face nailed at 24 inch centers. Coping shall be fastened on inside wall with hex head screws and bonded sealing washers through oversized holes in the back of the coping. Corners and angles shall be lapped and soldered; do not install joint sealant.

3.03 TESTING

A. Perform field water testing to demonstrate installation is watertight. Continue testing with a continuous hose stream applied at base of installation for at least 30 minutes. If leaking is observed, discontinue test and repair installation, then test until satisfactory results are obtained.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.05 CLEANING

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

OF SECTION END

SECTION 07 9200

JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Joint sealants.

2. Preparation for application of sealants.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 07 6000 - Flashing and Sheet Metal.

3. Division 08 - Openings.

4. Division 09 - Finishes.

1.02 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings indicating sealant joint locations, with full-size sealant joint details.

B. Product Data: Submit manufacturer's literature for each sealant material.

C. Material Samples: Submit Samples indicating color range available for each sealant material intended for installation in exposed locations.

D. Certifications: Submit manufacturer’s certification materials comply with requirements specified.

E. Site Samples: At locations required, provide a Sample of sealant for each typical installation, approximately 24 inches long, including joint preparation, backing, sealant and tooling. Allow backing to extend 6 inches beyond end of sealant for inspection of substrate.

F. Test Reports: Submit manufacturer's adhesion compatibility test reports according to ASTM C794 for each substrate.

1.03 QUALITY ASSURANCE

A. Qualifications of Installer: The Work of this section shall be installed by a firm which has been in the business of installing similar materials for at least five consecutive years; and can show evidence of satisfactory completion of five projects of similar size and scope.

Installer shall have applicators trained and approved by manufacturer for performing this Work.

1.04 DELIVERY, STORAGE AND HANDLING

A. Store in accordance with manufacturer's recommendations. Provide a uniform ambient temperature between 60 and 80 degrees F.

1.05 WARRANTY

A. Manufacturer: five year material warranty.

B. Installer: two year installation/application warranty.

PART 2 - PRODUCTS

2.01 GENERAL

A. Furnish sealants meeting following in-service requirements:

1. Normal curing schedules are permitted.

2. Non-staining, color fastness (resistance to color change), and durability when subjected to intense actinic (ultraviolet) radiation are required.

B. Furnish the products of only one manufacturer unless otherwise required, sealant colors as selected to match the adjoining surfaces.

2.02 MATERIALS

A. Sealants:

1. Sealant 1: Acrylic latex, one-part, non-sag, mildew resistant acrylic emulsion compound complying with ASTM C834, Type S, Grade NS, formulated to be paintable.

a. Tremco Inc., Acrylic Latex Caulk.

b. Pecora Corporation, AC-20.

c. Equal.

2. Sealant 2: Butyl sealant, one-part, non-sag, solvent-release-curing sealant complying with ASTM C1311, gun grade and formulated with a minimum of 75 percent solids.

a. Tremco Inc., Tremco Butyl Sealant.

b. Pecora Corp., BC-158.

c. Equal.

3. Sealant 3: Silicone sealant, one-part non-acid-curing silicone sealant complying with ASTM C920, Type S, Grade NS, Class 25.

   a. Dow Corning Corp., Dow Corning 790, 791, 795.

   b. General Electric Co., Silpruf.

   c. Tremco, Inc., Spectrem 1.

   d. Pecora Corp., 864.

   e. Equal.

4. Sealant 4: One-part mildew-resistant silicone sealant, complying with ASTM C920, Type S, Grade NS, Class 25.

   a. Dow Corning Corp., Dow Corning 786.

   b. General Electric Co., Sanitary 1700.

   c. Tremco, Inc., Proglaze White.

   d. Equal.

5. Sealant 5: One-part non-sag urethane sealant, complying with ASTM C920, Type S, Grade NS, Class 25.

   a. Sika Corporation, Sikaflex -221e.

   b. Equal.

6. Sealant 6: Multi-part pouring urethane sealant, complying with ASTM C920, Type M, Grade P, Class 25.

   a. Sika Corporation, Sikaflex 2C NS/SL.

   b. Equal.

7. Sealant 7: Acoustical sealant, non-drying, non-hardening permanently flexible conforming to ASTM D217.

   a. Pecora Corp., BA-98 Acoustical Sealant.

   b. Equal.

B. See 07 8413 - Penetration Firestopping for rated sealants.

C. Joint Backing: ASTM D1056; round, closed cell Polyethylene Foam Rod; oversized 30 to 50 percent larger than joint width, reticulated polyolefin foam.

D. Primer: Non-Staining Type. Provide primer as required and shall be product of manufacturer of installed sealant.

E. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer.

F. Sealants shall have normal curing schedules, shall be nonstaining, color fast and shall resist deterioration due to ultraviolet radiation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that joint openings are ready to receive Work and field tolerances are within the guidelines recommended by sealant manufacturer.

3.02 SURFACE PREPARATION

A. Joints and spaces to be sealed shall be completely cleaned of all dirt, dust, mortar, oil, and other foreign materials which might adversely affect sealing Work. Where necessary, degrease with a solvent or commercial degreasing agent. Surfaces shall be thoroughly dry before application of sealants.

B. If recommended by manufacturer, remove paint and other protective coatings from surfaces to be sealed before priming and installation of sealants.

C. Preparation of surfaces to receive sealant shall conform to the sealant manufacturer's specifications. Provide air pressure or other methods to achieve required results. Provide masking tape to keep sealants off surfaces that will be exposed in finished Work.

D. Etch concrete or masonry surfaces to remove excess alkalinity, unless sealant manufacturer's printed instructions indicate that alkalinity does not interfere with sealant bond and performance. Etch with 5 percent solution of muriatic acid; neutralize with dilute ammonia solution, rinse thoroughly with water and allow to dry before sealant installation.

E. Perform preparation in accordance with ASTM C804 for solvent release sealants, and ASTM C962 for elastomeric sealants.

F. Protect elements surrounding Work of this section from damage or disfiguration.

3.03 SEALANT APPLICATION SCHEDULE

	Location	Type	Color
A.	Exterior and Interior joints in horizontal surfaces of concrete; between metal and concrete masonry and mortar.	Sealant 6	To match adjacent material
B.	Exterior door, entrance and window frames. Exterior and interior vertical joints in concrete and masonry metal flashing.	Sealant 3 or 5	To match adjacent material

C.	Joints within glazed curtain wall system. Skylight framing system. Aluminum entrance system glass and glazing.	Sealant 3	Translucent or Black
D.	Interior joints in ceramic tile and at plumbing fixtures.	Sealant 4	Translucent or White
E.	Under thresholds.	Sealant 2	Black
F.	All interior joints not otherwise scheduled	Sealant 1	To Match Adjacent Surfaces
G.	Heads and sills, perimeters of frames and other openings in insulated partitions	Sealant 7	Match Adjacent Surfaces

3.04 APPLICATION

A. Provide sealant around all openings in exterior walls, and any other locations indicated or required for structure weatherproofing and/or waterproofing.

B. Sealants shall be installed by experienced mechanics using specified materials and proper tools. Preparatory Work (cleaning, etc.) and installation of sealant shall be as specified and in accordance with manufacturer's printed instructions and recommendations.

C. Concrete, masonry, and other porous surfaces, and any other surfaces if recommended by manufacturer, shall be primed before installing sealants. Primer shall be installed with a brush that will reach all parts of joints to be filled with sealant.

D. Sealants shall be stored and installed at temperatures as recommended by manufacturer. Sealants shall not be installed when they become too jelled to be discharged in a continuous flow from gun. Modification of sealants by addition of liquids, solvents, or powders is not permitted.

E. Sealants shall be installed with guns furnished with proper size nozzles. Sufficient pressure shall be furnished to fill all voids and joints solid. In sealing around openings, include entire perimeter of each opening, unless indicated or specified otherwise. Where gun installation is impracticable, suitable hand tools shall be provided.

F. Sealed joints shall be neatly pointed on flush surfaces with beading tool, and internal corners with a special tool. Excess material shall be cleanly removed. Sealant, where exposed, shall be free of wrinkles and uniformly smooth. Sealing shall be complete before final coats of paint are installed.

G. Comply with sealant manufacturer's printed instructions except where more stringent requirements are indicated on Drawings or specified.

H. Partially fill joints with joint backing material, furnishing only compatible materials, until joint depth does not exceed 1/2 inch joint width. Minimum joint width for metal to metal joints shall be 1/4 inch. Joint depth, shall be not less than 1/4 inch and not greater than 1/2 inch.

I. Install sealant under sufficient pressure to completely fill voids. Finish exposed joints smooth, flush with surfaces or recessed as indicated. Install non-tracking sealant to concrete expansion joints subject to foot or vehicular traffic.

J. Where joint depth prevents installation of standard bond breaker backing rod, furnish non-adhering tape covering to prevent bonding of sealant to back of joint. Under no circumstances shall sealant depth exceed 1/2 inch maximum, unless specifically indicated on Drawings.

K. Prime porous surfaces after cleaning. Pack joints deeper than 3/4 inch with joint backing to within 3/4 inch of surface. Completely fill joints and spaces with gun applied compound, forming a neat, smooth bead.

3.05 MISCELLANEOUS WORK

A. Sealing shall be provided wherever required to prevent light leakage as well as moisture leakage. Refer to Drawings for condition and related parts of Work.

B. Install sealants to depths as indicated or, if not indicated, as recommended by sealant manufacturer but within following general limitations:

1. For joints in concrete walks, slab and paving subject to traffic, fill joints to a depth equal to 75 percent of joint width, but not more than 3/4 inch deep or less than 3/8 inch deep, depending on joint width.

2. For building joints, fill joints to a depth equal to 50 percent of joint width, but not more than 1/2 inch deep or less than 1/4 inch deep.

3.06 CLEANING

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.07 CURING

A. Sealants shall cure in accordance with manufacturer's printed recommendations. Do not disturb seal until completely cured.

3.08 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 08 1113

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Hollow metal doors and frames or hollow metal doors as indicated.

2. Hollow metal window frames or hollow metal door and window frames.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 07 9200 - Joint Sealants.

3. Section 08 8000 - Glazing.

4. Section 09 9000 - Painting and Coating.

1.02 DESIGN REQUIREMENTS

A. Door-and-frame assemblies or frames shall include reinforcing and provisions for hardware as shown and specified. Drawings indicate profile and general details of steel frame fabrication and installation.

1.03 SUBMITTALS

A. Shop Drawings: Submit composite Shop Drawings indicating detailed relationships of installation including Work of adjacent construction, finish hardware, security, fire and life safety devices, glazing, sealing, and requirements for field installation. Include elevations of each hollow metal door type, details of each frame type, location schedule of doors and frames indicating same reference for details and openings as indicated on Drawings, conditions of openings of various wall sections and materials, typical and special details of construction, methods of assembling sections, location and installation requirements for hardware, material size, shape, and thickness, and joints and connections.

B. Product Data: Submit manufacturer's Product Data indicating composition and construction for each fabricated item including louvers, coatings, finishes, and other components demonstrating compliance with referenced standards.

C. Certification: Submit certification of compliance with referenced standards and specified criteria, including but not limited to fire ratings in accordance with UL 10C, Physical Endurance in accordance with ANSI A250.4 and Prime Paint performance in accordance with ANSI A250.10.

D. Samples:

1. Hollow Metal Frame: Corner section of typical exterior and interior frame, of sufficient composite size to illustrate corner joint construction, hinge reinforcement, closer re-enforcement, floor anchor, dust cover, and jamb anchors, and showing galvanizing and prime coat finishes.

2. Hollow Metal Door: Section of typical interior door of sufficient composite size to illustrate edge, top, bottom, and core construction, hinge reinforcement and face stiffening, closer reinforcement and kick plate reinforcement, and corner of vision opening construction with glazing beads.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum documented experience of more than five years in work of this section.

B. Installer Qualifications: Minimum documented experience of more than five years in work of this section

C. Coordinate with hardware supplier for fabrication of doors and frames to receive hardware items.

D. Coordinate with intrusion alarm supplier for fabrication of doors and frames to receive intrusion detection devices.

E. References: Work shall comply with physical and performance requirements of following standards, including standards referenced in them, except for more stringent provisions specified herein or required by regulatory agencies:

1. ANSI/SDI A250.8, SDI 100 Recommended Specifications for Standard Steel Doors and Fames.

2. ANSI/NFPA 252, Fire Tests of Door Assemblies.

3. ANSI/UL 10B, Fire Tests of Door Assemblies.

4. ANSI/UL 10C, Positive-Pressure Fire Tests of Door Assemblies.

5. ANSI/NFPA 80, Fire Doors and Fire Windows

6. HMMA, Guide Specifications for Commercial Hollow Metal Doors & Frames (Standard of National Association of Architectural Metal Manufacturers).

7. ANSI/SDI A250.4, Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcings.

8. ANSI A250.10, Test Procedure and Acceptance Criteria for Prime Painted Steel Doors and Frames.

9. ANSI A250.6, Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.

F. Standards of Fabrication and Installation:

1. Finished Work shall be of uniform profile, accurately fabricated, rigid and strong, square and true, neat in appearance, smooth and free from dents, waves, warps, buckles, open joints, tool marks and/or other defects.

2. Steel sheet shall be clean with smooth surfaces free of scale, pitting or other defects.

3. Construction joints shall be flush, tight and welded their full length, ground flush and smooth on exposed surfaces.

4. Frame and door reinforcing and hardware provisions shall be performed in fabrication shop. Provide cuts, welds, and other fabrications before galvanizing or shop priming.

5. Lines and molded members shall be straight and true with angles as sharp as practical for thickness involved, surfaces flat, and fastenings concealed.

1.05 DELIVERY, STORAGE AND HANDLING

A. Frames: Before shipment, install temporary spreaders at bottom of bucks and do not remove until frames are installed.

B. Doors: Provide protection as required to protect doors during shipping and storage. Damaged doors will be rejected.

C. Inspect hollow metal Work upon delivery for damage. Remove and replace damaged items with new Work as required.

D. Store doors and frames in an upright position at Project Site under cover and protected from weather-related elements. Store units on minimum 4-inch high wood blocking with ½ inch air spaces between stacked doors to provide circulation. Do not store doors and frames under plastic or canvas shelters that can create a humidity chamber. If shipping packaging becomes wet, immediately remove packaging.

1.06 WARRANTY

A. Manufacturer shall provide a five year material warranty.

B. Installer shall provide a two year fabrication and installation warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Doors and frames shall be products of a single manufacturer.

B. The following are acceptable manufacturers, as are others that can demonstrate their products are equivalent in quality, performance and compliance with these specifications.

1. Security Metal Products Corp.
2. Curries Manufacturing, Inc.
3. Steelcraft.
4. Amweld Metal Doors and Frames.
5. Stiles Custom Metal, Inc.
6. Door Components Inc.
7. CECO Door.
8. Equal.

C. Materials, fabrication and installation must comply with requirements of standards referenced in Section 1.04, Quality Assurance.

2.02 MATERIALS

A. Steel:

1. Exterior Doors and Frames: Galvanized Carbon Sheet Steel, Commercial Quality, A60 zinc coating (0.30 ounces per square foot per side), ASTM A653.
2. Interior Doors and Frames: Cold-Rolled Steel Sheets, Commercial Quality Carbon Steel, ASTM A1008.
3. Steel shall be free of scale, pitting, coil breaks or other surface blemishes, and free of buckles, waves or other defects.

4. Steel thicknesses expressed in steel gages (MSG) is for reference only. Actual steel thicknesses must meet minimum requirements of ASTM standards and as described in ANSI/SDI A250.8.

B. Supports and Anchors: Fabricate from a minimum 16 gauge galvanized sheet steel unless noted otherwise.

C. Fasteners: Provide as shown on Drawings and to suit conditions of secure installations. Furnish 304 Grade stainless steel types at exterior doors.

D. Door Louvers:

1. Louver free air flow shall be 50% free area.

2. Louvers for exterior doors shall be galvanized and furnished with not less than 12 gage frame and security grille welded to 18 gage steel blades, fully galvanized, with removable galvanized or bronze insect screen on inside. Install louver with tamperproof-head through-bolts. Anemostat PLSL, Air Louvers Inc. Model 1500-A, L & L Louvers, or equal.

3. Fusible link louvers: Listed by State Fire Marshal, UL labeled and installed with tamperproof fasteners.

4. Lightproof louvers (at dark rooms): DRDL by Anemostat, Air Louver Model 1000, L & L Louvers, or equal.

5. Louvers shall be comply with SDI 111C and be furnished with factory primer.

E. Vision panels: Manufacturer's standard, U.L. approved, finished flush with door face, with no visible fasteners on either door face.

F. Shop Paint:

1. Conform to Steel Structures Painting Council (SSPC) for steel components.

2. Pretreatment/priming coatings shall be compatible with Project site finish painting system in accordance with Section 09 9000.

3. At frames to be grouted, surfaces that are inaccessible after installation shall be coated with bituminous or asphaltic base paint.

2.03 FABRICATION GENERAL

A. General: Fabricate hollow metal units to be rigid, neat in appearance, and free from defects including warp or buckle.

1. Accurately form metal to required sizes and profiles. Fit and assemble units in manufacturer's plant. Where practical, factory or shop fit and assemble units for shipment.

2. Weld joints continuously; grind, dress, and make smooth, flush, and invisible. Filler to conceal manufacturing defects or damage is not permitted.

3. Corner Joints: Finish corner joints by mitering, or coping and butting, or a combination of both. Trim and backbend shall be continuous around corner.

4. Continuously weld joints for full depth and width of frame, trim, and backbends.

5. Clearances for Fire-Rated Doors: As required by NFPA 80.

2.04 FRAMES

A. General: Provide fully welded steel frames with integral stops and trim for doors, transoms, sidelights, borrowed lights, and other openings, and with details indicated for type and profile. Use concealed fastenings, unless otherwise indicated.

B. Metal Thickness of Frames (minimum):

1.	Interior hollow metal frames up to 4-foot wide	16 gage
2.	Interior hollow metal frames wider than 4-foot	14 gage
3.	Exterior hollow metal frames	14 gage
4.	Borrowed lights up to 4-foot wide	16 gage

C. Supports and Anchors: Fabricate from at least 16-gage, galvanized steel sheet. Frame anchors shall comply with fire rated label requirements of opening.

1. Floor Anchors:

a. Minimum thickness: 12 gage galvanized steel sheet or bent steel plate, securely fastened inside each jamb, with two holes in anchor at each jamb for 3/8 inch floor anchorage fasteners. For preframed wood stud walls provide and additional wood stud anchor located as close to the bottom of the jamb as is practical.

b. Where required at sloping and uneven floor conditions, or to coordinate adjustments for trim alignments, provide adjustable floor anchors, providing at least 2-inch height adjustments.

2. Jamb Anchors:

a. Locate anchors near top and bottom and at intermediate points not to exceed 24 inches on center. Provide two anchors per head for openings up to 48 inches wide; over 48 inches wide provide anchors at 24 inches on center maximum.

b. Anchors in masonry construction: Provide manufacturers standard jamb anchors. Steel wire complying with ASTM A510, 0.177 inch in diameter, may be furnished.

c. Anchors in Stud Partitions: Provide steel anchors, 16 gage minimum sheet steel, of design to suit partition construction, securely welded inside each jamb.

d. Through-Frame Anchors: At frames indicated to be anchored with bolts through frame, provide countersunk holes for bolts with 16 gauge minimum sheet steel stiffeners full thickness of frame, and securely welded inside each frame at each hole.

D. Inserts, Bolts, and Fasteners: Provide manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A153 Class C or D as required.

E. Head Reinforcing: Refer to Detail #2 of this section. Reinforcing shall not act as lintel or load-carrying member and shall comply with fire rating requirements. Provide at frames regardless of whether a closer is called for.

F. Hardware Reinforcement and Accessories:

1. Butt Hinge: 7 gage minimum.

2. Head assemblies: Reinforced internally with, full length, 10 gage angles on each side of frame and bar at bottom of stop for closer reinforcement in frames as shown in Detail #2 of this section.

3. Reinforcing for other items of finish hardware shall be accomplished according to ANSI A250.6.

4. Plaster Guards: Provide 26 gage galvanized steel plaster guards or dust cover boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

G. Mullion and Transom bars: Furnished and fabricated as specified for frames.

H. Glazed Openings: Applied stops with mitered or butted corners, of minimum 18 gage galvanized steel, one-piece lengths, secured within 3” of ends and at 12” centers with oval head countersunk tamper resistant screws. Corner joints shall be furnished with contact edges closed tight, with trim faces mitered and continuously welded. Frames

for multiple openings shall be provided with mullion and/or rail members, fabricated of closed tubular shapes with no visible seams or joints. Joints between faces of abutting members shall be securely welded and finished smooth. Provide condensate weeps 4 inches on centers, maximum.

I. Door Silencers: Except for exterior doors, drill and punch frames for three silencers at lock jamb of single swing doors or in double doors with astragal and one silencer per leaf in heads of doubled door frames.

J. Where frames are installed in walls sitting on a concrete curb, provide a closure plate or extend backbends to provide closure where frame abuts concrete curb.

2.05 DOORS

A. General: Custom-made, flush-panel "seamless type" with one-piece face panels; continuous weld, seamless edge construction with no visible seams or joints on faces or on vertical edges.

1. Provide type and size of doors shown with louvers and openings for glazing where indicated.

2. Door thickness: 1 ¾ inches.

3. Face Sheet Minimum Gage: 16 gage.

4. Stiffeners: Stiffen door face sheets with continuous vertical-formed steel (rib) sections or back to back hat sections, minimum 20 gage, full thickness of interior space between door faces, spaced 6" on center maximum, and spot welded to both faces 4" on center maximum.

5. Acoustical Insulation: Provide sound deadening and insulating material through entire core of door (full height, width, and thickness of door). Provide STC ratings where indicated on Drawings, scheduled, or for partition ratings indicated on Drawings.

a. Doors shall have a minimum STC of 28 as tested under ASTM E90 and ASTM E413, unless noted otherwise..

6. Thermal Insulation: Exterior doors shall be insulated to R values scheduled or indicated on drawings.

7. Labeled Doors: Where fire-rated openings and conditions are indicated.

a. Labeled doors shall be provided with fire-resistance rating indicated and shall be constructed as tested and approved by Underwriters' Laboratories (UL) for installation in labeled frame and door assemblies.

b. Gaskets: Gaskets are supplied under Section 08 7100 - Door Hardware. Gaskets and installation shall conform to requirements of NFPA 105, "Installation of Smoke and Draft Control Door Assemblies."

c. Fabricate labeled doors with same finished appearance as specified for non-labeled hollow metal doors; with welded door edges, filled and ground smooth; with label affixed to door.

d. Where fire labels are required and continuous hinge is specified, install label on top of door within 6" of hinge side of door.

8. Door Edges: Join door face sheets at vertical edges of door with continuous weld full height of door. Grind, fill, and dress welds smooth to provide invisible seam with smooth, flush surface.

a. Close ends of doors with continuous recessed channels, 16 gage steel minimum, spot welded to both face sheets. Close top and bottom edges of doors with a internal steel channel, screw attached into top and bottom of door. Channel shall be galvanized at exterior doors. No screws are allowed on visible faces of door. Provide openings in bottom closure of exterior doors to permit escape of entrapped moisture.

b. Profile of Door Edges:

1) Single-acting swing doors: Bevel both vertical edges 1/8" in 2".

2) Pairs of single-acting swing doors: Bevel hinge edge 1/8" in 2". Provide surface mounted astragals for labeled or unlabeled doors unless otherwise shown on Drawings or required.

3) Double-acting swing doors: Round both vertical edges on 2" minimum radius.

9. Door Louvers: Install according to manufacturers recommendations.

10. Glass Stops:

a. Furnish fixed stops integral with and welded at security side of door.

b. Finish: Factory primer.

11. Transom: Fabricate to requirements specified for flush doors.

B. Hardware Reinforcement and Accessories:

1. Provide sheet steel or plate reinforcement for finish hardware items wherever necessary. Mortise, drill and tap to template requirements for mortise type hardware.

2. Butt reinforcing: 7 gage minimum, of length 4" longer than length of butt. Minimum 3 spot welds at top and bottom.

3. Door closer reinforcement: 14 gage minimum steel channel, 6" high on each side of door. Reinforcement to extend full width of door in accordance with Detail #1 of this section.

4. Kick plate reinforcement: 14 gage minimum steel plate, 10" high on each side of door. Reinforcement to extend full width of door in accordance with Detail #1 of this section.

5. Other Hardware Requirements: Cut, reinforce, drill, and tap doors and frames for other hardware, including energy management switches or contacts and security devices, in accordance with furnished hardware templates for accessory items. Thickness and size of reinforcement shall be as required by ANSI A250.6.

2.06 SHOP PRIMING

A. Exposed and concealed metal surfaces of hollow metal doors, frames and other hollow metal Work of this Section shall be bonderized and then shop primed.

B. Exposed surfaces of doors, frames and accessories shall be filled, sanded smooth and cleaned before painting.

C. Exposed surfaces shall be shop primed after assembly.

PART 3 - EXECUTION

3.01 FRAME INSTALLATION

A. Install steel frames accurately in location, perfect alignment, plumb, straight and true. Brace frames to prevent displacement.

B. Anchor frames in concrete and concrete unit masonry with galvanized anchor bolts; 3/8 inch diameter, counter-sunk at 24 inches on center at head and jamb unless noted otherwise.

C. Anchor frames in steel and wood frame partitions with manufacturer recommended anchors.

D. Install frame at fire rated openings in accordance with NFPA Standard No. 80.

E. Furnish filler for anchor attachment screws, and sand smooth.

3.02 DOOR INSTALLATION

A. Install steel doors in accordance with manufacturer's instructions and as indicated on Drawings and in Finish Hardware Specifications. Coordinate with Work of other trades.

B. Ensure that door and jamb clearances comply with requirements of ANSI/NFPA 80.

C. Adjust operable parts for correct function.

D. Remove hardware, except primer-coated items, tag, box and install after finish painting has been completed.

3.03 PRIME COAT TOUCH-UP

A. Immediately after installation, remove rust, repair damaged surfaces to new condition, sand smooth, and install touch-up primer.

3.04 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off Project site.

3.05 PROTECTION

A. Protect Work of this section until Substantial Completion.

END OF SECTION

SECTION 08 3323

OVERHEAD COILING DOORS AND GRILLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Overhead coiling doors and grilles as indicated.

B. Related Requirements:

2. Section 09 9000- Painting and Coating.

3. Division 26 - Electrical.

1.02 DESIGN REQUIREMENTS

A. Drawings indicate sizes, locations, profiles, and general details of overhead coiling door and grille construction and installation.

B. Performance Requirements:

1. Wind load: Design, engineer and fabricate doors to withstand at least twenty pounds per square foot wind load.

2. Operation-cycle requirements: Design coiling doors and grilles components to a standard minimum of 25 cycles per day and a minimum of 50,000 operating cycles for the life of the door.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's specifications, rough-in diagrams, installation instruction and manufacturer's data. Submit manufacturer's data on locking devices, which are included in this Work.

B. Shop Drawings: Indicate materials, anchorage, and installation details. Indicate details and location of vehicle sensors in pavement. Indicate concrete curb installation of pass card receiver.

C. Closeout Submittals: Operation and Maintenance Data.

1.04 REGULATORY REQUIREMENTS

A. Fire rated coiling doors shall bear a label of UL, Warnock Hersey, FMG or other nationally recognized testing laboratory for the fire ratings listed on the drawings, and shall be approved for use by the California State Fire Marshall and DSA.

1.05 DELIVERY, STORAGE AND HANDLING

A. Provide protection as required by manufacturer to protect products from damage during shipping and storage.

1.06 WARRANTY

A. Provide manufacturer's two year warranty against defects in materials, fabrication, and installation.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Provide overhead coiling doors and grilles complete with guides, hoods, operating mechanism, and special features and control systems. Doors shall be as manufactured by The Cookson Company, Inc., Cornell Iron Works, Inc., Lawrence Roll-Up Doors, Inc., or equal.

2.02 OVERHEAD COILING DOORS

A. Curtain: Constructed of interconnected strip steel slats conforming to ASTM A653.

1. Slats: At least 20 gage, strip steel, flat-faced section, 5/8 inch minimum deep. Fit alternate slats with end locks and where required by wind loads, furnish wind locks.

B. Bottom Bar: Shall consist of two galvanized ASTM A123 steel angles placed back to back and mechanically joined together, with vinyl or neoprene closure strip.

C. Barrel: Furnished curtain shall be coiled on a steel tube or pipe of size sufficient to carry door load with a deflection not to exceed .03 inch per foot of opening width. Curtain weight shall be evenly balanced by helical torsion springs. Spring tension shall be adjustable by means of an adjusting wheel accessible from outside. Finish steel tube with one coat of rust-inhibiting prime paint.

D. Brackets: 3/16 inch thick minimum, steel plate designed to house ends of door coils.

E. Hood: Galvanized sheet steel, 24 gage, contoured to fit brackets and reinforced to prevent sag. Furnish to field obtained dimensions.

F. Guides: Fabricate of 3/16 inch minimum structural steel shaped to form a slot of sufficient depth to retain curtain under normal wind load. Where wind locks are required, guides shall be provided with wind lock bars.

G. Gears: High grade cast iron with teeth cast from machine cut patterns. Gear ratio shall be designed for a maximum manual effort of 30 to 35 pounds to operate door.

H. Weatherstripping: Exterior doors shall be fully weatherstripped with replaceable weather seals at bottom bar and guides, and at hood with a weather baffle.

I. Finish: Curtain and hood:

1. Hot dipped galvanized ASTM A123.

2. Bonderized coating for prime coat adhesion.

3. Baked-on corrosion inhibiting primer and top coat.

4. Bottom bar, guides and brackets shall have a factory spray applied rust inhibiting primer finish.

5. Color shall be as selected by Architect from manufacturer's standard range of colors.

J. Operation: Unless otherwise indicated, doors shall be manually operated.

1. Doors 80 square feet in area or less with maximum height of 7 feet shall be push-up type with lift handles on bottom bar.

2. Doors over 80 square feet in area shall be chain-gear operated by galvanized hand chain.

3. Doors shall be furnished with provision for padlocking from the inside.

2.03 OVERHEAD COILING FIRE DOORS

A. Overhead coiling fire doors shall be same as specified for overhead coiling doors, except they shall be automatic closing type.

B. Doors over 12 feet wide, 12 feet high, 120 square feet in area, shall bear an Oversize Door Label.

C. Automatic Closing: Furnish doors with a closing device and governor, which automatically becomes operative upon activation of a fusible link. Governor shall regulate downward speed of curtain. Door shall have an average closing speed of not less than 6 inches per second and not more than 24 inches per second. Chain (crank and motor) operated fire doors shall automatically close without a loss of spring tension. Doors shall be easily reset by reconnecting the fusible link cable or chain and shall not require restoring spring tension.

D. Slat End Locks, Hood and Flame Baffles: Provide in accordance with UL requirements.

E. Finish: Curtain, Hood, Bottom Bar, Guides and Brackets finish:

1. Hot dipped galvanized G90 coating conforming to ASTM A653.

2. Bonderized coating for prime coat adhesion.

3. Baked-on corrosion inhibiting primer and top coat.

4. Bottom bar, guides and brackets shall have factory spray applied rust inhibiting primer finish.

5. Color shall be as selected by Architect from manufacturer's standard range of colors.

2.04 ELECTRICALLY OPERATED OVERHEAD COILING DOORS AND GRILLES

A. Door Fabrication: Same as specified for overhead coiling doors.

1. Provide electric sensing/weather edge seal installed along width of door bottom bar meeting UL 325 requirements. When activated Automatic sensing switch will prevent door from closing, so door will return to the completely open position.

B. Grille:

1. Curtain: Shall be heavy duty with a straight link pattern, fabricated of solid horizontal 5/16 inch round aluminum rods, spaced not to exceed 1-5/8 inches on center, joined by aluminum links at intervals of approximately 9 inches on center.

2. Bottom Bar: Electric sensing/weather edge seal installed along width of door bottom bar meeting UL 325 requirements. When activated Automatic sensing switch will prevent door from closing, so door will return to the completely open position.

3. Guides: Construct of 3/16 inch minimum thick continuous steel wall angle connected to a continuous aluminum guide section. Insert continuous nylon wearstrips on both sides of the guide to eliminate metal to metal contact.

4. Brackets: Construct of steel 3/16 inch minimum thick.

5. Barrel: Curtain shall be coiled on a steel tube or pipe of size sufficient to carry door load with a deflection not to exceed 0.03 inch per foot of opening width. Curtain weight shall be evenly balanced by helical torsion springs. Spring tension shall be adjustable by means of an adjusting wheel accessible from outside. Finish steel tube with one coat of bronze rust-inhibiting prime paint.

6. Hood: Fabricate from 0.040 aluminum sheet and formed to fit the curvature of the brackets.

7. Finish: Curtain, Bottom Bar, Guides and Hood shall be 204-R1 clear anodized. Brackets and wall angles shall have a factory spray applied rust inhibiting primer finish.

C. Motor Operation: Motor shall be high starting torque, with sufficient power to operate door at an approximate average speed of 2/3 foot per second. Unit shall be controlled by an adjustable screw-type limit switch, which will break the circuit at termination of travel. High efficiency in line gear drive shall be furnished, together with a spring-set solenoid-operated brake completely housed to protect against damage, dust and moisture. An emergency hand chain operator, which does not affect the timing of the limit switch, shall be provided to operate the door in case of power failure or removal of motor for inspection or servicing. Operator shall be designed to transmit motion to the door through an adequately size roller chain and sprocket reduction system. An

efficient overload protection device, which will break the control circuit and protect against damage to motor windings, shall be installed integral with the unit.

1. The unit shall be furnished with an interlocked reversing contactor, and operating components preconnected to a terminal strip within the control box to facilitate field connection to power source and control system.

2. The size of the motor shall be determined by the manufacturer to meet the design criteria. Motor rating shall be 208 volts, three phase, 60 Hz.

3. Provide a time delay on reverse under a steady stream of vehicle traffic.

4. System shall be designed to operate for at least 100,000 cycles.

5. Counter: Provide a device, which will record the cumulative amount of vehicles passing through the door.

D. Control System:

1. The system shall be activated by a card key placed into a card reader. Sensor loops shall be installed for entry and exit at the overhead coiling door, or grille to prevent closing when a vehicle is present. Provide electric sensing/weather edge seal installed along width of door bottom bar meeting UL 325 requirements. When activated Automatic sensing switch will prevent door from closing, so door will return to the completely open position.

2. When door is on its downward cycle, the system shall provide the capability, upon activation of a sensor, to interrupt the downward cycle and open the door.

3. Provide a keyed bypass switch to override the sensor system and test the door operation. Lock shall be keyed to building keying system.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation shall be by an authorized installer of coiling overhead door or grille manufacturer.

B. Install curtains and operating equipment plumb, in true alignment, free of springing, forcing, racking or distortion.

C. Provide necessary hardware, anchors, inserts, hanger and equipment supports in accordance with manufacturer's literature, as indicated.

D. Fasten curtain guide assembly to adjacent members with galvanized fasteners at 24 inches on center for a rigid installation of curtain and operating equipment.

E. Upon completion of installation, lubricate, test and adjust rolling doors and grilles to operate easily, free from warp, twist or distortion and fitting properly around entire perimeter.

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 08 5113

ALUMINUM WINDOWS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Aluminum windows as indicated.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 07 60 00 – Flashing and Sheet Metal.
3. Section 07 9200 - Joint Sealants.
4. Section 08 8000 - Glazing.
5. Section 09 2423 - Cement Plaster and Metal Lath.

1.02 REFERENCE STANDARDS

A. ASTM International:

1. ASTM A36 - Standard Specification for Carbon Structural Steel.
2. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
3. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
4. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors by Uniform or Cyclic Static Air Pressure Difference.
5. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
6. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
7. ASTM E547 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference.
8. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage through Installed Windows and Doors.

9. ASTM E972 - Standard Test Method for Solar Photometric Transmittance of Sheet Materials Using Sunlight.

10. ASTM E1105 - Standard test Method for Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls and Doors by Uniform or Cyclic Static Air Pressure Difference.

11. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact.

B. American Architectural Manufacturers Association (AAMA):

1. AAMA/WDMA/CSA 101/I.S.2/A440 NAFS – North American Fenestration Standards / Specifications for Windows, Doors and Skylights.

2. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products.

3. AAMA 511 - Voluntary Guideline for Forensic Water Penetration Testing of Fenestration Products.

4. AAMA 513 - Standard Laboratory Test Method for Determination of Forces and Motions Required to Activate Operable Parts of CW and AW Class Operable Windows, Sliding Glass Doors and Terrace Doors in Accessible Spaces.

5. AAMA 609 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum.

6. AAMA 612 - Voluntary Specification, Performance Requirements, and Test Procedures Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum.

7. AAMA 701 / 702 – Voluntary Specification for Pile Weatherstripping and Replaceable Fenestration Weatherseals.

8. AAMA 800 - Voluntary Specifications and Test Methods for Sealants.

9. AAMA 803.3 - Narrow-Joint Seam Sealer.

10. AAMA 902 - Voluntary Specification, Performance Requirements and Test Procedures for Sash Balances.

11. AAMA 904.1 – Voluntary Specifications for Friction Hinges in Window Applications.

12. AAMA 910 - Voluntary Life Cycle Specifications and Test Methods for AW Class Architectural Windows and Doors.

13. AAMA 1302.5 - Voluntary Specifications for Forced-Entry Resistant Aluminum Prime Windows.

14. AAMA 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Architectural Extrusions and Panels.

C. National Fenestration Rating Council (NFRC):

1. NFRC-100- Standard Procedure for Determining Fenestration Product U-factors.

2. NFRC-200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

D. Glass Association of North America (GANA):

1. GANA 01-0300 - Proper Procedures for Cleaning Architectural Glass Products.

E. The Aluminum Association (AA):

1. AA DAF-45 – Designation System for Aluminum Finishes.

1.03 AAMA PRIMARY DESIGNATOR

A. Primary Designator: Way in which compliant windows are identified by the American Architectural Manufacturers Association (AAMA). Consists of a four part code:

1. Performance Class: Is the likely target application for a door or window. Four classes are defined by the North American Fenestration Standards (NAFS) and corresponds to the first two letters of the designator. Only Performance Class AW is specified in this Section.

a. AW: Performance Class of windows commonly used in high-rise and mid-rise buildings to meet extreme loading requirements and limits on deflection.

2. Performance Grade (PG): Corresponds to the digits of the designator and represents the Design Pressure, in pounds per square foot, a window specimen was tested to.

3. Test Size: Is the maximum size tested to achieve this rating. Test Size is not used in the window designators specified in this Section.

4. Product Type: Is the abbreviation for the window type specified, corresponds to the last two letters of the Primary Designator.

1.04 PERFORMANCE REQUIREMENTS

A. Windows shall conform to AAMA/WDMA/CSA 101/I.S. 2/A440, Performance Class AW. Performance Grade shall be as indicated on Part 2 Products, for each specific manufacturer and each window type.

B. Performance Requirements: Window manufacturer shall hold a current test report for a window specimen successfully tested to the gateway performance requirements of AAMA/WDMA/CSA 101/I.S. 2/A440, Performance Class AW.

1. Life Cycle Testing: Tested in accordance with AAMA 910. There shall be no damage to fasteners, hardware parts, support arms, activating

mechanisms, or any other damage that would cause the window to be inoperable.

2. Structural Performance:

   a. Uniform Load Deflection Test:

      1) With ventilators closed and locked, test unit in accordance with ASTM E330 at a static air pressure difference of 40 PSF, positive and negative pressure.

      2) No member shall deflect over L/175 of its span.

   b. Uniform Load Structural Test:

      1) With ventilators closed and locked, test unit in accordance with ASTM E330 at a static air pressure difference of 60 PSF, both positive and negative.

      2) At conclusion of test there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms, nor any other damage that would cause the window to be inoperable.

3. Water Penetration Resistance: With ventilators closed and locked, test unit in accordance with ASTM E331 and/or ASTM E547 to twenty percent of the Design Pressure, without exceeding 12 PSF. There shall be no uncontrolled water leakage.

4. Air Leakage Resistance: With ventilators closed and locked, test unit in accordance with ASTM E283 at a static air pressure difference of 6.24 PSF.

   a. Single Hung, Double Hung Windows and Horizontal Sliding Windows: Air infiltration rate shall not exceed 0.30 cfm/SF.

   b. Fixed, Awning, Hopper Casement and: Air infiltration rate shall not exceed 0.10 cfm/SF.

5. Forced Entry Resistance: Test windows in accordance to ASTM F588 or AAMA 1302.5 and meet the requirements of performance level 40.

1.05 REGULATORY REQUIREMENTS

A. Manufactured windows shall comply with the requirements of the California Energy Code, Section 110.6, Mandatory Requirements for Fenestration Products and Exterior Doors.

1. Air Leakage: As indicated in Article 1.03, Performance Requirements.

2. U-factor: Windows shall be rated in accordance with NFRC-100 or use the applicable default U-factor set forth in table 110.6-A.

3. Solar Heat Gain Coefficient (SHGC): Window SHGC shall be rated in accordance with NFRC-200, or use the applicable SHGC set forth in table 110.6-A.

4. Visible Transmittance (VT): The window VT shall be rated in accordance with NFRC-200 or ASTM E972.

5. Labeling: Conform to Section 110.6 for temporary and permanent labels.

1.06 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings for the Work of this section including plans, elevations, window schedule, opening identification symbols, sizes, and complete details for materials, finishes, sizes, profiles, moldings, dimensioned locations of hardware items with reinforcement, methods of anchoring, size and spacing of anchors, assembly, erection, isolation, glazing procedure as well as re-glazing procedures, materials, caulking and sound transmission class.

B. Product Data: Submit manufacturer's Product Data, recommendations and standard details for aluminum windows units, including independent laboratory certified tests as necessary to demonstrate compliance with specified requirements.

C. Material Samples:

1. Window Samples: Submit a window sample fabricated of the materials, finish, fasteners, glazing, panning and caulking system specified.

2. Finish: When factory-finish color coating is specified, submit:

a. Five color charts of standard factory coatings.

b. Five coated six inch long sections of aluminum sheets finished with color selected by ARCHITECT.

D. Certificates:

1. AAMA Certified Test Reports: Window manufacturer shall affix AAMA Quality Certified label on every unit or shall submit a certified test report from an approved testing laboratory, certifying that the specified insulated glass window complies with ANSI/AAMA requirements.

2. Building Energy Efficiency Standards Certified Test Reports: Window manufacturer shall affix a clearly visible temporary label to the non-insulated glass windows or supply a project specific label certificate using NFRC CMA protocol, listing the U-Factors, solar heat gain coefficients (SHGC), visible transmittance (VT) and air leakage for the fenestration products to adhere to the prescriptive requirements of Title 24, CEC.

3. Submit a certificate bearing official and legal signature of window supplier stating that the finish complies with AAMA 2605 for Organic Coatings and to AAMA 612 for Anodic Finish, as applicable.

4. Submit a certificate bearing official and legal signature of window supplier stating that windows with security glazing had the glass installed in accordance with Section 08 8053, Security Glazing.

B. Written statement signed by the sealant manufacturer or distributor stating that the sealant joints shown on the shop drawings have been reviewed and approved for adhesion and surfaces compatibility.

1.07 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Except for more stringent requirements specified in this Section, manufactured aluminum windows shall comply with the requirements of the CBC Part 6, California Energy Code, Section 110.6, Mandatory Requirements for Fenestration Products and Exterior Doors.

2. Windows shall be designed to withstand the minimum loads prescribed in CBC Section 1609A.

B. Field applied products that release VOC's, such as sealants, caulking, adhesives, primers and paints, shall be approved by the OWNER's Office of Environmental Health and Safety (OEHS).

C. Installer Qualifications:

1. Minimum five year experience installing windows of the type specified by this Section.

2. Installer shall be approved by the window manufacturer as an approved installer.

D. Manufacturer Qualifications: Minimum 5 year experience in producing aluminum windows of the type specified. Window manufacturer technical representative shall provide field services to verify window installation is in accordance to manufacturer's written instructions.

E. Pre-Installation Conference: CONTRACTOR shall coordinate and conduct pre-installation conference in accordance to Section 01 3119, Project Meetings, to review the progress of construction activities and preparations for the installation of aluminum windows and other related work of this Section.

F. Commissioning:

1. Commissioning Services Provider (CxSP) retained by the OWNER will provide Commissioning (Cx) of building envelope systems and assemblies, including submittal review, installation, testing, documentation, and training, as indicated in Section 07 0800, Commissioning of Thermal and Moisture Protection.

2. CONTRACTOR shall follow the commissioning responsibilities stated in Section 01 9113, General Commissioning Requirements.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's packaging to protect windows during transportation and storage.

B. Store windows indoors in a clean ventilated area and stack vertically on edge with wood or plastic shims between components to provide water drainage and air circulation.

C. Handle in a manner to evenly distribute material load and prevent twisting, ending and cracking of windows doors and associated parts.

1.09 WARRANTY

A. Window installation shall be warranted by CONTRACTOR against defects under normal use and service, for a period of two years.

B. Windows shall be warranted by window manufacturer against defects in material and fabrication under normal use and service, for a period of five years.

C. Pigmented organic finished window and related components shall be warranted for ten years against blistering, cracking, peeling or chipping or fading beyond AAMA 2605.

D. Anodized finished window and related components shall be warranted for five years against blistering, cracking, peeling or chipping or fading beyond AAMA 612.

E. Factory glazed insulated glass units shall be warranted to be free from obstruction of vision as a result of dust or film formation on the internal glass surfaces caused by failure of the hermetic seal due to defects in material and workmanship for a period of ten years.

PART 2 – PRODUCTS

2.01 MANUFACTURERS, SERIES AND AAMA PRIMARY DESIGNATORS

A. Fixed Windows (FW):

1. Arcadia, T200, AW-PG80-FW.
2. EFCO, 2700, AW-PG140-FW.
3. Kawneer, 8225-TL, AW-PG100-FW.
4. Peerless, G641, AW-PG70-FW.
5. Equal.

2.02 FABRICATION

A. Aluminum windows shall conform to AAMA/WDMA/CSA 101/I.S.2/A440.

B. Window frames, sash members and muntin bars, shall be extruded aluminum sections of 6063-T5 or 6063-T6 alloy.

C. Windows shall be factory fabricated for inside glazing, of the types and sizes indicated and specified, and shall include hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for a complete installation and proper operation. Windows shall be fabricated for inside glazing, except for double-hung type windows.

D. Frames and sashes corners shall be a mechanically joined construction by means of two screws secured into integral screw ports. Corner joints shall be "seam sealed" with a quality grade sealant meeting the requirements of AAMA 803.3 and made watertight.

E. When single hung windows are constructed from double hung sash, non-operating section shall be fixed in closed position by means of a welded stop or by screws through section into window frame from inside. Exposed fasteners on exterior surfaces are not permitted.

F. At mullions, frame members of jamb shall be securely interlocked to form continuous watertight mullion. Reinforce with ASTM A36 steel channels or plates or ASTM A653 shaped sheets when required to conform to the CBC and ASCE 7 deflection criteria. Apply zinc rich primer or other AAMA acceptable methods to protect dissimilar metals.

G. Sash Design:

1. Sash shall allow for insulated glass of the thickness specified. Horizontal sash rails shall be of tubular profile. Horizontal true muntins shall be coped and attached to sash members by means of rivets, screws, or welded.

2. Sash shall be removable from window frames after installation.

3. Weatherstrips and weatherseals shall conform to AAMA 701. Provide replaceable woven pile fin weather-stripping contained in extruded grooves around entire perimeter of vents.

4. Hung windows: Lift rail on bottom sash interior; mechanical meeting rail interlock; with weep holes for drainage.

5. Sliding windows: Continuous extruded pull rail on operable sash interior; mechanical meeting rail interlock; with weep holes for drainage.

H. Reinforcing members, if used, shall be made from aluminum, stainless steel, or another corrosion-resistant base material compatible with aluminum.

I. Weatherstrips / weatherseals: Shall be secured in position, replaceable, and meet the design qualification provisions of the following Standards, as applicable:

2.03 GLAZING

1. Glazing shall be wet glazed type with an extruded aluminum snap-on glazing bead at the interior. Sashes shall be factory glazed by the manufacturer to provide proper seal.
2. Glazing beads shall be extruded aluminum of window manufacturer's standard design, 5/8 inch minimum height, cut to proper length.
3. For glass and glass setting materials refer to Section 08 8000, Glazing.

J. Fasteners: Provide concealed anchors conforming to AAMA/WDMA/CSA 101/I.S.2/A440 of the type recommended by the window manufacturer for the specific type of construction. Anchors and fasteners shall be compatible with the aluminum window and the adjoining construction materials.

2.04 FINISH

A. Organic finish applied over a five stage aluminum pre-treatment. Finish shall be a Two coat pigmented organic coating system applied over a five stage aluminum pre-treatment to a minimum of 1.2 mil thickness and conforming with AAMA 2605. Color shall be selected by the ARCHITECT.

2.05 SEALANTS

A. Sealants shall be approved by the OWNERS's OEHS and shall be of the type recommended by the window manufacturer.

B. Sealants shall conform with AAMA 800 and shall be compatible with aluminum finish and adjacent materials.

C. Sealants used to seal mechanically fixed joints, it shall conform to AAMA 800 or ASTM C920, Type S, Grade S, Class 25.

D. Refer to Section 07 9200, Joint Sealants, for additional information.

2.06 GLASS

A. Refer to Section 08 8000, Glazing.

PART 3- EXECUTION

3.01 EXAMINATION

A. Verify that conditions of substrate are acceptable for aluminum window installation in accordance with manufacturer's written recommendations.

B. Verify openings are dimensionally correct and within allowable tolerances, and substrates are plumb, level and clean.

C. Verify that anchoring surface is in accordance with approved shop drawings.

D. Inform OAR of unacceptable conditions immediately upon discovery.

E. Proceed with installation only after unacceptable conditions have been remedied.

3.02 INSTALLATION

A. Windows and operators shall be installed in accordance with the window manufacturer's printed instructions and details. Set windows plumb, square, level, and true within their respective openings. Adjoining units of windows or assembly of windows shall be installed in the same plane and with rails, muntins, and like members accurately aligned.

B. Aluminum in contact with plaster, concrete or steel shall be separated from dissimilar materials as recommended in the Appendix to AAMA/WDMA/CSA 101/I.S.2/A440. Screws, rivets, bolts and other fastening devices shall be of aluminum, non-magnetic stainless steel or other non-corrosive materials compatible with aluminum.

C. Apply sealant in conformance to Section 07 9200, Joint Sealants, in sufficient quantity at joints and intersections to provide a weathertight seal between the window and surrounding construction. Wipe off excess and leave exposed sealant surfaces clean and smooth.

D. Security glazing shall be installed with Dow 795 sealant as indicated on Section 08 8053, Security Glazing.

E. Upon completion of the Work of this section, inspect windows and operating devices for proper installation and operation. Operate vents and hardware and adjust to ensure proper fitting and functioning and leave in smoothly operating condition. Lubricate hardware and operating parts as necessary.

F. Where indicated on the Drawings a two piece snap together receptor shall be furnished to fasten windows in place. The receptor aluminum finish shall match the window frame. When snapped together, system shall fasten window securely in place with no water penetration at specified test pressure.

G. Where indicated on the Drawings provide panning, which shall be either a receiver or attached type. The panning extrusions shall be field secured at the corners with stainless steel screws in integral screw ports with the joints back sealed to prevent water intrusion. Exposed screws or fasteners on the exterior of the panning are not permitted. Panning and trim shall be furnished in the same color and finish as window system frames.

H. Limit the opening of windows without security screens to 6 inches where window sills are at a height of ten feet or more above grade, balconies, stairs or lower roofs.

3.03 FIELD QUALITY CONTROL

A. Conduct on-site tests in conformance with AAMA 502, with the OAR, ARCHITECT and CxSP present. The OAR will select units to be tested. Testing shall be performed by an AAMA accredited testing agency paid by the CONTRACTOR.

B. Testing shall be performed as soon as possible after window installation and before drywall installation to allow visual access. AAMA 502 cannot be used for windows

that have been installed for more than six months. In the case windows have been installed for more than six months the procedures of AAMA 511 shall be followed.

C. Ten percent of installed windows shall be selected for testing. If one or more windows fail, additional ten percent of windows, not including the ones previously tested, will be selected for further testing. Selection of additional ten percent of windows and retesting shall be performed until no leaks occur.

1. Air-Infiltration Test: Test set-up and equipment requirements for the test shall be in accordance to the requirements of ASTM E783. Windows shall be tested at 6.24 PSF field test pressure differential. Allowable rates for air leakage shall be 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for AW performance class when testing according to AAMA 502, as follows:

   a. Compression Seal and Fixed Windows: 0.15 cfm/ft^2.

   b. Sliding Seal Windows: 0.45 cfm/ft^2.

2. Water-Resistance Test: Test set-up and equipment requirements for the water penetration portion of the test shall be in accordance to the requirements of ASTM E1105, Method A, using a non-cyclic static pressure difference, and shall test the entire window assembly including perimeter joints. No water penetration is allowed.

   a. The test pressure used shall be equal to two thirds of the tested and rated laboratory performance test pressure (twenty percent of the Performance Grade listed in Part 2 for each window type; however, shall not exceed twelve pounds per square feet.)

   b. Windows with accessible hardware are permitted certain reductions in air infiltration and water resistance performance requirements in accordance with AAMA 513.

   c. If water leakage occurs and source cannot be determined, a forensic evaluation using the procedures stated in AAMA 511 shall follow.

D. Windows failing to meet specified air or water infiltration testing:

1. CONTRACTOR shall submit proposed remedial work to ARCHITECT for review.

2. CONTRACTOR shall complete remedial work as revised by the ARCHITECT.

3. When test results meet specified requirements, CONTRACTOR shall incorporate remedial work into other work on the Project.

E. Field Test report shall be submitted to the OWNER, CONTRACTOR, CxSP and ARCHITECT. Field Test report must include the following:

1. Name of the testing agency and testing agency's credentials.

2. Date of test.

3. Standards complied with during testing.
4. Number and locations of specimens tested.
5. Thorough analysis of test result indicating passing or failing of specimens at pressures specified.
6. Photos illustrating conditions of failed compliance at pressures required.

3.03 CLEANING

A. Clean interior and exterior surfaces of window frames of mortar, plaster, paint spattering spots, and other foreign matter in conformance with AAMA 609 and manufacturer's written recommendations.

B. Clean glass using methods complying with GANA 01-0300.

C. Touch-up, repair or replace damaged products before Substantial Completion.

3.04 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 08 7100

DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Door hardware.
2. Door Hardware Schedule.
3. Fire Department Key Vault.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 08 1113 - Hollow Metal Doors and Frames.
3. Section 08 3323 - Overhead Coiling Doors and Grilles.

1.02 DESIGN REQUIREMENTS

A. Design Requirements:

1. Exit doors, including each leaf of a pair of doors, shall always be operable from the inside by the simple turn of a lever or by pushing an exit device without the use of a key or any special knowledge or effort; this includes doors of toilet and storage rooms.
2. Unless otherwise specified, hand activated door opening hardware shall be located 36 inches above the finish floor.
3. Dead bolts are not permitted unless operable with a single effort by a lever type hardware.
4. The force applied to operate exit hardware shall not require more than 15 lbs. applied in the direction of travel.

B. Regulatory Requirements:

1. Comply with CBC requirements.

2. Hardware for fire doors shall conform to requirements of UL - Fire Protection and Accident Hazard Equipment and the California State Fire Marshal listing, NFPA - 80 and CBC requirements for positive pressure testing.

3. Hardware shall meet the requirements of CBC, Chapter 11B.

1.03 SUBMITTALS

A. Product Data: Finish Hardware Schedule:

1. Submit schedule including recap sheet:

a. Include manufacturer's name, catalog number, relevant dimensions, fasteners, location of item in Work, door index number, frame material, door material, door size and thickness, door type, handing, fire-rating (if any), and sound-rating (if any).

b. Hardware shall be listed by "Headings" in following manner:

1) HARDWARE GROUP NO. 01

1 SINGLE/PAIR OF DOORS NO. (Room and Number) from/to (Room and Number)

1 SINGLE/PAIR OF DOORS NO. (Room and Number) from/to (Room and Number)

List of finish hardware

2) HARDWARE GROUP NO. 02, etc.

B. Material Samples: Submit Samples of door hardware as required by Architect.

1.04 QUALITY ASSURANCE

A. Each type of finish hardware furnished for the Work shall be of same make or manufacture, unless otherwise specified. Where existing items are being supplemented with new items, match existing items, subject to current code requirements and accessibility recommendations.

B. Coordinate and deliver templates or physical Samples of finish hardware items to manufacturer of interfacing items, such as doors and frames, in a timely manner to insure orderly progress of Work.

C. Comply with the following as a minimum requirement:

1. Conform to Builders Hardware Manufacturers Association (BHMA) Finish Code, latest edition.

2. DHI WDHS.3: Recommended Locations for Architectural Hardware for Wood Flush Doors

3. DHI WDHS.4: Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors.

4. HMMA 831: Recommended Hardware Locations for Custom Hollow Metal Doors and Frames

1.05 DELIVERY, STORAGE AND HANDLING

A. Package each item of hardware and each lockset individually, complete with necessary installation instructions, screws and fastenings, and installation templates; marked with item number corresponding to number on Finish Hardware Schedule.

1.06 WARRANTY

A. Manufacturer shall provide a minimum two year material warranty except as follows:

1. Provide a ten year manufacturer's material warranty for door closers.

2. Provide a five year manufacturer's material warranty for locksets and exit devices.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Butts and Hinges:

1. Width of hinges shall be of sufficient size to clear trim. Where provided with magnetic holders, hinge width shall be of sufficient size to ensure door is parallel to wall when magnetic holders are engaged.

2. Furnish one pair of hinges for door leaves up to 5-foot high. Furnish one additional hinge for every additional 30 inches or fraction thereof.

3. Butts for doors shall be non-rising, loose pins, with button tip.

4. Exterior and interior out-swinging doors with butt hinges shall be furnished with hinges furnished with a setscrew in hinge barrel to make pin non-removable (NRP); Butt hinges at exterior out-swinging doors shall have stainless steel pins and bearings.

5. Hinges installed on painted doors shall be BHMA 600 finishes. Hinges installed on stained and varnished doors shall be BHMA 626 for bronze/brass base metals and BHMA 652 for steel base metal. Exterior doors shall have non-ferrous hinges. Fire-rated doors shall have steel or stainless steel hinges.

B. Locksets and Trim:

1. Unless otherwise specified, locks shall be of mortise type, complying with ANSI A156.13, grade 1.

2. Unless otherwise specified, escutcheons shall be 7 ½-inch by 2 ¼-inch wide by 0.050 thick minimum.

3. Levers shall be cast, and shall return to within ½ inch of face of door.

4. Outside lever shall be pinned. Inside lever shall be by "Allen Head Set Screw" or by "Spanner Ring Nut".

5. Lock strikes shall be curved lip type, with exposed edges and corners rounded, of sufficient length to protect jamb and trim, and shall not extend more than 1/8 inch beyond trim, jambs or face of doors in pairs. At out-swinging pairs with overlapping astragal, strike shall have a 7/8 inch lip-to-center dimension. Dust box shall be provided for door locks.

6. Locksets throughout shall be lever type of same manufacture.

C. Exit Devices:

1. Unless otherwise specified, exterior doors shall be furnished with rim touch bar device; right hand reverse active leaf - night latch function by cylinder by hardened cylinder ring by flush pull by sex nut and bolt. Left-hand reverse inactive leaf - exit only by flush pull by sex nut and bolt.

2. Unless otherwise specified, interior doors shall be furnished with rim touch bar device; right hand reverse active leaf-lever handle by cylinder, left hand reverse inactive leaf; exit only.

3. Fire labeled exit devices shall conform to UL label requirements and be listed by the California State Fire Marshal.

4. Exit devices throughout shall be touch bar types of same manufacture. Exit devices shall meet ANSI BHMA, A153.3 Grade 1.

5. Lever design shall match lock levers.

6. Exit devices shall be furnished sized for the specific door width and height.

D. Door Closers:

1. Door closers shall conform to ANSI A156.4, Grade 1.

2. Door closers shall be heavy duty, rigid parallel arm; provide regular arm for regular bevel doors.

3. Door closer shall be full rack and pinion type, adjustable back check, and sweep and latch speed with key regulating screws.

4. Door closer shall have full fitted cover of plastic or stainless steel, attached to door closer body with tamperproof screws.

5. Provide spacer block or support bracket for securing fifth screw on closer arm shoe. Provide special brackets, shoes, or other attachment devices as required.

6. Maximum pressure to operate doors shall not exceed following:

   a. Fire rated doors: The authority having jurisdiction may determine the maximum force, not to exceed 15.0 pounds to operate fire doors to achieve positive latching.

   b. Exterior doors: 5.0 pounds.

   c. Interior doors: 5.0 pounds.

7. Door closers shall be installed at the following:

   a. Exterior doors.

   b. Fire rated doors.

   c. Corridor doors.

   d. Toilet doors.

E. Protection Plates: Furnish kick plates of 10-inch high by 2-inch less door width on single doors, 10-inch high by 1 inch less door width on pairs of doors. Provide one plate for push side of closer-equipped doors. Furnish mop plates 4-inch high by 1 inch less door width on doors swinging into toilet rooms.

   1. Kick and mop plates shall be a minimum 0.050 inch thick; Type 304 stainless steel, with finished beveled edges (B4E).

F. Stops:

   1. Floor stops shall be mounted to protect door and trim.

   2. Furnish stop of appropriate height, minimum ¾ inch above undercut of door.

   3. Where the specified floor stop cannot be installed or would present a pedestrian hazard, omit and furnish a heavy-duty overhead stop (626 finish); if closer is specified, furnish closer with integral spring-cushion stop arm.

G. Weather stripping/Gasketing:

1. Install gaskets and intumescent seals on fire rated doors and frames.

2. Unless otherwise specified, install weather stripping on doors from air-conditioned spaces to the exterior: fastener-applied frame seals, nylon-brush door sweeps, and, at pairs, astragals.

H. Thresholds: Unless otherwise specified, thresholds shall conform to CBC Chapter 11B accessibility standards and ADAAG.

I. Push Plates: Plates shall be 0.050 thick, 6-inch by 16-inch minimum, with beveled edges.

1. Door Pulls: Pulls shall have protective plate mounted under pull, 0.050 inches thick, 4-inch by 16-inch beveled on four edges.

2. Hardware Cutouts: Pull plates and push plates installed over locking hardware shall have cylinder and turn lever cutouts as required.

J. Automatic Flush Bolts:

1. Strike plates for automatic bolts shall be provided for active door.

2. Provide dust proof strikes for bottom bolts.

K. Coordinators:

1. Provide brackets as required for items fastened to coordinators.

2. Provide door strike plates for both doors with coordinators.

L. Smoke Detectors and Magnetic Holders: Coordinate electrical devices with Division 26 and the Drawings.

M. Fasteners: Shall match finish of hardware. Provide fasteners for all hardware at toilet rooms, custodian rooms, kitchen doors, and exterior doors: stainless steel for chrome, aluminum, or stainless finish hardware; brass or bronze for brass or bronze finish hardware.

N. Key vault: Locate box as indicated on drawings.

1. Knox Box: Model 4400 series for low rise buildings with recessed mounting kit, or other as approved by local fire authority.

2. Construction: High Security Industrial/Government key box. UL listed double-action rotating tumblers and hardened steel pins accessed by a biased cut key. ¼" thick steel housing with ½ inch thick steel door with interior gasket seal and stainless steel door hinge. Lock shall have a 1/8 inch thick steel dust cover with tamper seal mounting capability.

3. Installation of Key Vault: Refer to manufacturer's printed instructions and LA City Fire Department's Fire Prevention Bureau's Requirement 75. Connect wiring conduit through one of the holes provided.

4. Labeling: The word "FIRE" shall be placed on the Key Box door in ¾ inch contrasting letters

2.02 FINISH

A. Unless otherwise specified, finish of hardware shall be dull chromium-plated BHMA 652 for steel-based metals, BHMA 626 for brass-based metals, except for kickplate, escutcheons, push plates, lock strike plates, and exit device touch bars, which shall be BHMA 630. Levers for locksets and exit devices shall be BHMA 626.

B. Unless otherwise specified, overhead door closers and brackets shall be BHMA 689, to match other finish hardware in same room or space.

2.03 CYLINDERS AND KEYING

A. Project shall be keyed in accordance with keying schedule, prepared and furnished by the District.

B. Provide a cylinder security collar (SPEC. NO. 42) at each exterior door cylinder. Provide cylinder collars and spacers at all cylinders as needed to provide a neat, tight and secure fit of the cylinder to the locking hardware.

C. Permanent Cylinders:

1. Permanent cylinders shall be standard core type, 7-pins maximum.

a. Permanent cylinders as manufactured by [SCHLAGE] shall be Owner furnished. The Work of this section includes obtaining the permanent cylinders from the Owner, and pinning, stamping, and installing.

b. Provide to the District an approved hardware schedule and floor plans. District shall return with keying added to the approved hardware schedule, bitting chart, and a complete sample set of permanent keys. District will provide notification when the cylinders are available for pick-up.

2. Permanent cylinders shall be pinned with third-party (e.g., "LAB") 0.005 inch increment pins.

3. Pin cylinders according to District-furnished sample set of permanent keys, District-furnished bitting chart and District-furnished key schedule.

4. Change keys and master keys shall operate inside and outside cylinder on two cylinder locks, unless otherwise indicated.

5. Provide the set number of change key only stamped on cylinder faces.

D. Key Control:

1. Permanent cylinders and sample set of permanent keys shall be not used during the construction phase of the Project. Temporary construction cylinders and keys used for securing the Work is included as part of the Work of this section and will not be provided by the Owner.

2. Upon Substantial Completion of the Work, sample set of original keys shall be returned to the OAR. Duplication of Owner keys, or retaining keys, is not permitted.

3. Provide four unstamped, uncut nickel silver key blanks per cylinder to the OAR prior to Substantial Completion. Key blanks shall be by the permanent cylinder manufacturer and of the same keyway as the sample set of permanent keys or keyway designated by Owner.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Finish hardware shall be installed as specified in Finish Hardware Schedule.

1. Placement of Hardware: Finish hardware shall be installed as indicated on hardware placement sheets attached to end of this section.

2. Provide necessary screws, bolts, anchors, and fastenings, of required sizes and type for proper installation of hardware. Exposed screws shall have Phillips heads, and wood screws shall be fully threaded.

3. Fitting: Hardware shall be accurately fitted and, with exception of prime-coated butt hinges, bar-type coordinators, and flat astragals, shall be removed before finish painting is installed. Upon completion of finish painting and/or sealing, permanently install the hardware.

4. Anchorage of Hardware: Hardware fastened to concrete, masonry, or gunite construction shall be provided with drop-in expansion anchors by "Red Head Multi Set II", “Rawl Steel”, or as otherwise required by hardware manufacturer. Pilot holes of suitably lesser diameter shall be drilled prior to the insertion of wood and sheet metal screws.

5. Door escutcheons and push plates shall be installed with stainless steel or bronze, oval, "Phillips Head", fully threaded screws, not less than 3/4 inch - No. 6.

6. Exit devices shall be mounted with non-ferrous sex nuts and fully threaded machine screws, except where through bolts engage outside trim of locking case.

7. Mullion strike shall be installed with fully threaded machine screws.

8. Door closer shall be installed for maximum degree of opening of each door.

9. Following shall be installed with sex nuts and fully threaded machine screws.

   a. Door closers.

   b. Door pulls.

10. Install exterior doorstops as required. On new concrete, stops shall be installed with 1/4-20 screws. On asphalt concrete, stops shall be installed with 1/4-20 screws to an anchor plate set in a concrete monument. Anchor plate shall be Trimco 1268, or equal. Floor stops shall not be located in the path of travel and shall be located no more than 4 inches from walls.

11. Kickplate:

   a. Kickplates shall be installed with screws at each corner, and screws evenly spaced along each side not more than 3 inches apart on centers.

   b. Except on wood doors, screws shall be undercut pan head.

12. Thresholds shall be installed with 1/4-20 screws, set in Pour-Roc or mastic per section 07 9200, and coped to trim.

13. Sound Seals and Weather stripping / Gasketing:

   a. A mounting screw shall be installed within 2 inches of cuts or corners of weather stripping and/or gasketing.

   b. Sound seals and weather stripping and/or gasketing shall be installed with No. 8 - 3/4 inch Tek Phillips pan head screws.

3.02 ADJUSTING AND CLEANING

A. Before Substantial Completion, hardware shall be cleaned and inspected. Where hardware is deemed defective, repair or replace as required.

B. Door Closers: Final adjustments shall be performed before Substantial Completion, with mechanical system balanced and in operation.

3.03 EXAMINATION

A. Upon completion of installation, verify correct installation of hardware, according to reviewed Hardware Schedule and Keying Schedule. Verify that finish hardware is in optimum working condition.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

FINISH HARDWARE SCHEDULE

A. HARDWARE GROUP 01

Door # 07

1 EA MARKAR FM300 WEP 630 HINGE
1 EA MARKAR FM300 WEP X WT 630 HINGE
1 EA L9080 06A 626 LESS OUTSIDE TRIM
1 EA IVES VR900 630
1 EA SCHLAGE 30-137 626 MORTISE HOUSING
1 EA SCHLAGE 23-030 E KWY 626 CORE
1 EA LCN 4040 EDA 689 CLOSER (INSTALL DOOR CLOSER ON PUSH SIDE TO SWING 180)
1 EA PEMKO SWEEP 18061 CNB 36"
1 EA PEMKO THRESHOLD 176 AL 36"
1 EA PEMKO DOOR SEAL 2891 APK 3684
1 EA TRIMCO 1209 HO DOOR STOP

B. HARDWARE GROUP 02

Roll Up Door # 20

HARDWARE PER MANUFACTURER

END OF SECTION

SECTION 08 8000

GLAZING

PART 1 - GENERAL

1.01. SUMMARY

A. Section Includes:

1. Glass and glazing as indicated.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 08 5113 - Aluminum Windows.

1.02. SUBMITTALS

A. Product Data: Submit manufacturer's descriptive literature and installation recommendations for glass, glazing, and accessories.

B. Material Samples: Submit 6-inch square units of each type of glass specified.

1.03. QUALITY ASSURANCE

A. Labeling: Label each piece of glass and glazing and mirrors with manufacturer's name, and the grade or quality of the material. Labels shall be intact before and after installation. Fire-protection-rated glazing shall bear a label or other identification in accordance to the CBC.

B. Comply with the following as a minimum requirement:

1. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

2. ASTM C1036 - Standard Specification for Flat Glass.

3. ASTM C1048 - Standard Specification For Heat-Strengthened and Fully Tempered Flat Glass.

4. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass.

5. CPSC 16 CFR 1201 - Safety Standards for Architectural Glazing Materials issued by the Consumer Products Safety Commission.

6. ANSI Z97.1 – Safety Glazing Materials Used in Buildings.

7. GANA - Glazing Manual.

C. Qualifications of Installer: Minimum five years experience installing glass in projects of similar scope and complexity.

1.04. DELIVERY, STORAGE AND HANDLING

A. Deliver glass and glazing materials with manufacturer's labels intact.

B. Do not remove labels until glass has been installed and inspected by the Project Inspector.

C. Protect glass from staining, marking, and damage.

D. Putty and glazing compound shall be delivered to the Project site in manufacturer's original unbroken containers labeled to identify contents.

1.05. PROJECT CONDITIONS

A. Perform glazing when ambient temperature is above 40 degrees F.

B. Perform glazing on clean, dry surfaces only.

1.06. WARRANTY

A. Manufacturer shall provide a five year material warranty.

B. Manufacturer shall provide a five year material warranty for coatings and thermally or acoustically rated insulation units against deterioration in acoustic or thermal rating.

C. Installer shall provide a three year fabrications and installation warranty.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS AND FABRICATORS

A. To maximum extent possible, provide domestically manufactured and fabricated glass, and provide glass from one manufacturer.

B. Types of glass specified or indicated shall be manufactured or fabricated by one of the following:

1. Pilkington LOF (fire rated glazing).

2. PPG Glass Technology.

3. Visteon Float Glass Operations.

4. Viracon.

5. Southwest Technologies.

6. Equal.

2.02 GLASS MATERIALS

A. General: Conform to ASTM C1036, ASTM C1048, ASTM C1172 and to ANSI Z97.1. Label factory cut panes.

B. Tempered Glass: Condition A (uncoated surfaces), Type I or II, Class 1, Quality q3 (glazing select), Kind FT (fully tempered glass), match color of clear or tinted glass as applicable; fully thermal tempered, heat strengthening or chemical tempering is not permitted. Perform tempering by horizontal oscillating roller hearth or high speed roller hearth process. Do not permit fabrication processes leaving gripper or tong marks. Handle and size glass according to manufacturer's written instructions.

2.03 GLASS SETTING MATERIALS

A. Glazing materials and accessories shall be fully compatible with the materials and finishes with which they are in contact.

B. Setting Blocks: ASTM C864, channel shape; having ¼ inch internal depth, Shore A hardness of 80 to 90 Durometer. Blocks shall be a minimum 2 inch long. Block width shall be approximately 1/16 inch less than the full width of the rabbet. Block thickness shall be at least 3/16 inch, sized for rabbet depth as required.

C. Spacers: ASTM C864, channel shape, with ¼ inch internal depth, 3/32 inch flanges, eb, 1/8 inch thick, one to 3 inches long. Spacers shall provide Shore A hardness of 40 to 50 Durometer.

D. Vinyl Glazing Channels: Profile compatible with framing system and designed to accommodate glass of specified thickness, light gray in color. Provide for dry glazing aluminum frames where indicated or permitted.

E. Glazing Tape: Poly-isobutylene based sealant tape, conforming to AAMA 804.1, with adhesive one side protected by temporary paper cover, Extru-Seal manufactured by Pecora Corp., No. 303 by Protective Treatments, Inc., or equal.

F. Spring Steel Spacers: Galvanized steel wire or strip designed to position glazing in channel or rabbet sash with stops.

G. Glazing Clips: Galvanized steel spring wire designed to hold glass in position in rabbet sash without stops.

H. Glazing Points (Sprigs): Pure zinc stock, thin, flat, triangular or diamond-shaped pieces, 1/4 inch minimum size.

I. Glazing Sealants for Metal Sash: GE Silicones Silglaze II 2800, GE Silicones Silpruf, GE Silicones 1200 Silicone, and Dow Corning 999A. Polybutylene, oleoresinous,

asphalt, and oil base sealants are not permitted. Provide sealant of same color as structural silicone sealant unless otherwise required.

J. Glazing Compound for Wood Sash: Provide acrylic latex glazing compound for bedding and sealing glass in wood frames

K. Glazing Compounds and Sealants for Thermoplastic: Provide silicone, butyl, or polysulfide glazing compound.

PART 3 - EXECUTION

3.01 TOLERANCES

A. Thickness indicated or specified are nominal within standard tolerances. Maximum size of vertical panes shall not exceed the following:

Float Thickness:	1/8 inch	3/16 inch	1/4 inch
Maximum Areas in Square Feet:	9	16	20

When exceeding these square foot measurements glass is to be safety glazed.

3.02 INSTALLATION, GENERAL

A. Glazed cabinet doors, windows, transoms, and fixtures, not otherwise noted or indicated, shall be glazed with clear float glass. Room or entrance doors shall be glazed with clear wire glass with impact film.

B. Obscure glass in exterior openings shall be installed with smooth side of glass to weather. Patterned glass shall be installed with pattern running vertically, unless otherwise indicated.

C. Glazing tapes or sealants shall be installed wherever glass contacts wood or metal surfaces. Width of strips shall be as required.

D. Glazing compound shall be neatly and cleanly installed in straight lines, even with inside edge of sash members. Thumb puttying is not permitted.

E. Display Cases and Sliding Glass Doors in Casework: Glass in display cases shall be ¼ inch clear laminated glass as indicated. Edges of glass shall be rounded and polished.

F. Serving windows in cafeterias with speak holes shall be laminated safety glass.

G. Glazing Aluminum Sash: Glazing material in aluminum sash shall be installed in compound and secured in place with aluminum glazing beads. In addition, horizontal beads shall be installed with 6-inch by 1 inch, type A, self-tapping, stainless steel, Phillips-head screws, installed into pre-drilled, counter-sunk holes and spaced 2 inches from each end and 9 inches on centers.

H. Speak holes shall be installed according to glass manufacturer's written recommendations.

3.03 INSTALLATION OF GLASS

A. Conform to requirements of GANA Glazing Manual.

B. Provide edge blocking to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer.

C. Provide compressible filler rods or equivalent back-up material to prevent sealant from extruding into glass channel weep systems, from adhering to back surface of joints and to control depth of sealant for optimum performance.

D. Force sealants into glazing channels, in manner to eliminate voids and to ensure complete bond of sealant to glass and channel surfaces.

E. Tool exposed surfaces of sealants to provide for drainage away from glass. Install pressurized tapes and gaskets to protrude slightly out of channel to eliminate dirt and moisture pockets.

F. Where dry glazing of aluminum frame is indicated or permitted, provide vinyl glazing channels installed in accordance with frame manufacturers written recommendations. Do not stretch channels. Miter corners.

G. For tape glazing, furnish tape of thickness to provide approximately 30 percent compression. Cut tape to proper length and install to permanent stops, the entire length of the head and sill first, then to jambs. Butt tape together with no overlap and remove paper backing. Install glass on setting blocks at quarter points and maintain uniform glass edge clearance around entire perimeter of glass. Maintain manufacturer's recommended edge clearance and bite on glass. Install glass firmly into tape with a slight lateral movement to assure proper adhesion. Install tape to removable stop with evenly distributed firmness, smoothing out wrinkles in tape. Secure removable stop in proper position so tape makes contact with glass as stop is installed, forcing contact with glass and completely sealing joint. Remove excess tape from both sides at slight angle oversight line. Do not undercut.

3.04 PROTECTION AND CLEANING

A. Protect exterior glass from breakage by furnishing crossed streamers attached to framing and away from glass surface. Do not directly install markers to glass surfaces. Remove non-permanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove immediately by method 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 often than once a month, for build-up of dirt, scum, alkali deposits or staining. When examination reveals presence of these forms of residue, remove by method recommended by glass

manufacturer. Glazing, which cannot be cleaned to a required condition, shall be deemed defective Work.

D. Remove and replace glass, which is broken, chipped, cracked, abraded, or damaged during construction.

E. Remove protective covering from thermoplastic not more than 4 days before Substantial Completion, and immediately before cleaning. Methods of final cleaning and finishing shall be as prescribed by thermoplastic glazing publications referenced above.

F. Wash glass on both faces not more than four days before Substantial Completion. Wash glass by method recommended by glass manufacturer. Do not furnish harsh cleaning agents, caustics, abrasives, or acids for cleaning. Polish glass both sides and leave free of soil, streaks, and labels.

3.05 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.06 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 09 2216

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Non-structural metal framing.

2. Slotted system for positive attachment of metal studs to fluted steel decks for head of wall expansion joint movement (cyclic).

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 07 9200 – Joint Sealants.

3. Section 09 2423 - Cement Plaster and Metal Lath.

4. Section 09 2900 - Gypsum Board.

1.02 PROJECT REQUIREMENTS

A. Regulatory Requirements: Comply with DSA and CBC requirements.

B. Design Requirements:

1. Metal Studs: Studs for interior partitions shall be roll-formed channel or C-shapes.

2. Track: Stud track for floor and ceiling anchorage shall be channel configuration, sized to fit studs. Galvanized steel as manufactured for installation with specified metal studs.

3. Design: Design is based on minimum 5 pounds per square foot load applied perpendicular to walls. Deflection shall not exceed 1/240 under design load.

C. Performance Requirements: The top track fire-rated assembly, when incorporated into stud systems and tested in conjunction with products specified in Sections 07 8116 and/or 07 8413, shall exhibit the following performance characteristics:

1. Cyclic System: When tested for cyclical movement, in accordance with UL 2079.

2. When subsequently tested for one- and two-hour fire-resistive rated construction, in accordance with ASTM E119 and ASTM E814, assembly shall conform to requirements for hose stream resistance.

1.03 SUBMITTALS

A. Shop Drawings: Submit drawings showing framing, connection details, accessories and anchorage. Indicate location of assemblies and size and spacing of framing components.

B. Product Data: Submit manufacturer's catalog data for each item proposed for installation.

C. Certificates: Furnish manufacturer's certification that materials meet or exceed Specification requirements.

1.04 DEFINITIONS

A. Cyclic Anchoring Method: A system which provides for positive attachment (as described in ASTM C754) of studs to upper track, and of track to overhead fluted deck, while permitting up to 1-inch of vertical movement.

B. System: The application of the above products in their entirety as tested. There can be no intermixing of components unless specifically outlined in the appropriate test reports.

1.05 QUALITY ASSURANCE

A. Coordinate with related Work to provide blocking for items mounted on finished surfaces and to provide allowances for pipes and other items inside partitions and walls.

B. Comply with following as a minimum requirement:

1. American Welding Society (AWS): Structural Welding Code Steel (D1.1); and Structural Welding Code Sheet Steel (D1.3).

2. ASTM Standards:

a. ASTM A641 – Standard Specification for Zinc Coated (Galvanized) Carbon Steel Wire.

b. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

c. ASTM A1003 –Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

d. ASTM C645 – Standard Specification for Non-Structural Steel Framing Members.

e. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

f. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

g. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials.

h. ASTM E814 - Standard Test Methods for Fire Tests of Penetration Firestop Systems.

3. Underwriter Laboratories (UL):

a. UL 94 – Classification and Flame-Retardant Thermoplastics.

b. UL 2079 - Standard for Safety Tests for Fire Resistance of Building Joint Systems.

4. American Iron and Steel Institute:

a. North American Standard for Cold Formed Steel Framing – Nonstructural Members.

5. Military Specifications (MIL-P):

a. Paint High Zinc Dust Content, Galvanizing Repair

C. Tolerances: Install walls and partitions on straight lines, plumb, free of twists or other defects, and contacting a 10-foot straightedge for its entire length at any location within a 1/8 inch tolerance. Install horizontal framing level within a tolerance of 1/8 inch in 12 feet in any direction.

D. Manufacturers shall be members of the Steel Framing Industry Association (SFIA) or the Steel Stud Manufacturers Association (SSMA).

1.06 DELIVERY, STORAGE AND HANDLING

A. Materials shall be delivered in their original unopened packages and stored protected from damage. Do not store material directly on grade. Provide adequate support to prevent bowing of material prior to installation.

B. Store welding electrodes in accordance with AWS D12.1.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Non-structural metal framing:

1. ClarkDietrich.

2. Marino/Ware.

3. Cemco.

4. Equal.

B. Top Track Systems:

1. BlazeFrame DSL or MaxTrak by ClarkDietrich, or equal. Down-standing legs shall be nominally 2 1/2-inch and shall be provided with 1 1/2-inch slots at 1 inch on center.

2. VertiTrack or VertiClip System by The Steel Network, Inc. or equal. Pre-assembled track with clips installed to match stud spacing. Clips with attached bushing and screws to allow stud movement.

3. System must provide for minimum tested overall movement of 3/4” up and 3/4" down.

4. Track shall be provided in standard widths of 4 and 6 inches and in 16, 18, and 20 gage (54, 43, and 33 mil) sheet steel thickness, as required by Project conditions and detailed.

2.02 MATERIALS

A. Light Gage Metal Framing:

1. Metal framing shall be formed from corrosion resistant-steel conforming to requirements of ASTM A653, 33 ksi minimum.

2. Metal framing shall be manufactured in conformance to AISI S220 and zinc coated to G60 per ASTM C645/AISI S220.

3. Install metal framing according to ASTM C754.

B. Studs: SFIA , Intertek CCRR - 0204SSMA, ICC-ES ER-3064, minimum yield 33 ksi, hot-dipped galvanized sheet steel, G-60, C Stud type, punched web (except tracks and joists), C-shaped, sizes required to conform to details and scheduled wall thicknesses. Studs shall be rolled from new steel sheet and shall not be produced from re-rolled steel. Stud flanges shall not be less than 1 1/4-inch wide; track legs, not less than 1 ¼-inch wide.

1. Wall Framing and Furring for Plaster and Mortar Beds: Studs and tracks shall be 18 gage (43 mil) minimum, unless otherwise indicated.

2. Wall Framing and Furring for Gypsum Wallboard: Studs and tracks shall be 20 gage (30 mils) 33 ksi unless otherwise indicated.

3. Load-Bearing Studs: Studs and members 18 gage (43 mil) and thicker shall conform to requirements of Section 05 4100 - Structural Metal Stud Framing.

4. Stud gages indicated on Drawings or specified are the minimum. Where required stud height and/or loads exceed code requirements or manufacturer's recommendations, provide heavier gage studs and/or decrease stud spacing as necessary to conform to code requirements.

C. Suspended and Furred Ceiling Systems and Wall Furring: Suspended ceiling framing system shall support finished ceiling, light fixtures, air diffusers, and accessories, as required. Suspension system shall provide a maximum deflection of L/240. Carrying channels shall be fabricated from minimum 0.0538 inch thick cold-rolled steel, 1 ½-inch wide by 1/2 inch deep. Carrying channels for supports under ducts shall be 2 inches in size as specified. Carrying channels shall be fabricated from hot-dip galvanized coated sheet.

1. Plaster Ceilings: Cross furring members shall conform to AISI S220, and shall be fabricated from cold-rolled steel, 7/8 inch wide by 1/2 inch wide flange. Furring members shall be fabricated from hot-dip galvanized coated sheet.

2. Gypsum Wallboard Ceilings: Furring members shall be fabricated from cold-rolled steel, 7/8 inch by 2-23/32-inch. Furring members shall be fabricated from hot-dip galvanized coated sheet.

D. Ceilings:

1. Framed Ceilings: Framed ceiling framing system shall support finished ceiling, light fixtures, air diffusers, and accessories, as required. Suspension system shall provide a maximum deflection of L/240.

2. Plaster and Gypsum Wallboard Ceilings: Ceiling joists shall conform to AISI S220, hot-dip galvanized coated steel, C-shaped, unpunched, 20 gage (30 mil) minimum, unless noted otherwise.

E. Shaft Wall Framing Members: CH or CT studs and J runners, 20 gage (30 mil) minimum for 2-1/2, 4 or 6 inch studs, conforming to AISI S220, fabricated of steel conforming to ASTM A653, hot-dip galvanized.

F. Framing Accessories: Provide standard related accessories including floor and ceiling tracks, clips, web stiffeners, anchors, and similar items, of same manufacture as each type of stud specified, and as required for a complete installation.

G. Splay Wires and Compression Struts: Approved manufacturers acceptable to manufacturer of ceiling grids, gages and types as required by building codes for ceiling types and weights specified.

H. Wires: Soft-annealed galvanized steel wire per ASTM A641, 8 gage for hanger wires and 16 gage for framing unless otherwise specified.

I. Fasteners: Wafer-head screws, self-drilling type for 20 gage (30 mil) metal and heavier. ASTM C954 self-drilling, self-tapping screws, Type S-12 pan head, 1/2 inch long.

J. Fire Rated Acoustical Foam Tape: Compressible, closed cell polyvinyl chloride foam with pressure sensitive adhesive, in rolls with protective release liner on non-adhesive face, 6 pounds per cubic foot density, 1 inch wide x not less than 1/4 inch thick, self-extinguishing, UL 94 recognized, Norseal V740FR, manufactured by Norton Performance Plastics Corporation, or equal.

K. Acoustical Sealant: Permanently resilient type, non-hardening, as specified in Section 07 9200.

L. Zinc-Rich Paint: Conform to MIL-P-21035. "Cold Galvanizing Compound", manufactured by ZRC Products Company, or equal. Provide for touch-up of galvanized surfaces.

M. Steel Backing Plates: Provide a minimum 4 inch wide by l6 gage (54 mil) steel, or sections of studs and stud track welded or fastened to web of studs, except as otherwise indicated. Apply galvanizing coat.

N. Anchorage Devices Powder Actuated: Minimum 0.177 inch diameter by 1-7/16 inch long fasteners in regular concrete and 0.145 inch diameter by 1 1/8-inch long fasteners in lightweight concrete. Allowable shear and tension values as permitted in ICC ES reports shall be reduced to 80 percent.

O. Anchorage Devices, Drilled Expansion Anchors: Minimum 3/8 inch diameter with 2-1/4 inch embedment. Allowable shear and tension values as permitted in ICC ES reports shall be reduced to 80 percent.

P. Top Track System Materials:

1. Forming steel shall be mill certified prime steel:

a. For 0.0538 inch sections, conform to ASTM A1003, Grade 50 with a minimum yield point of 50,000 psi.

b. For 0.0428 and 0.0329 inch sections, conform to ASTM A1003, Grade 33, with a minimum yield point of 33,000 psi.

c. Formed steel shall be provided with galvanizing in accordance with ASTM A653 for a G60 zinc coating.

2. Fasteners:

a. For attachment of steel studs to slotted track or deflection clip, minimum No.8 corrosion resistant by ½ inch waferhead screws.

b. For attachment of track system to overhead structural element or metal decking, as provided for by the structural details affecting the Work.

3. Sprayed-on Fireproofing:

a. Sprayed-on fireproofing shall be as specified in Section 07 8116 - Cementitious Fire Proofing.

4. Dry Method:

a. Dry mineral wool and sealant system shall use only such products as are represented to have been fully tested and approved under UL 2079 and as specified in Section 07 8413 - Penetration Firestopping.

b. Mineral wool shall be compressed to the degree as used on approval fire and hose stream test.

c. The system supplier shall provide a measuring device capable of determining compression to determine compliance with required density.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that overhead or concealed Work is completed, tested, inspected, and finished as required before starting Work of this section.

3.02 INSTALLATION

A. Walls and Partitions:

1. Fasten floor runners for exterior walls and interior partitions to concrete slab with required power driven fasteners. Spacing of fasteners not to exceed 24 inches on center. Fasten ceiling runners to structure as by top track system manufacturer.

2. Sound insulated walls and partitions: Embed floor runner tracks in two beads of acoustical sealant or two runs of compressible tape seal. Install top track nested into slotted track system, in same manner for full height of walls. Where wall ends abutting concrete, masonry, or steel set end studs in two beads of acoustical sealant or two tape seals and secure at 4-foot centers vertically.

3. Space studs not over 16 inch on center unless indicated otherwise. Studs shall be located approximately 2 inches from door frame jambs, abutting partitions and partition corners, except those providing support for door and window openings.

4. Furnish and install manufacturer's standard floor track. Fasten track to floor by means of 1/4 inch by 1 1/4-inch Star "Dryvin" hammer drive anchors or 3/16 inch by 1 inch round head, "Rawl-Drives" one-piece expansion bolts spaced

not to exceed 3 feet, and installed in drilled holes in slab, or to wood joist with nails as indicated. Track may be fastened to concrete floor slabs with, power-driven fasteners.

5. Studs shall be seated squarely in track with stud web and flanges abutting track web, plumbed and securely fastened with sheet metal screws, to flanges or web of both floor and top tracks. Provide 4 screws per stud.

6. Where there is no suspended ceiling, tops of stud walls shall be provided with track and shoes and be fastened as specified for floors. Welding of studs to ceiling track will not be permitted except where bearing studs are installed.

7. Over metal doorframes, install a cut-to-length section of runner track, with flanges slit and web-bent to allow flanges to overlap adjacent vertical studs, and securely fasten to studs. At doorjambs, extend studs continuous to structure above.

8. Bridging, or horizontal bracing of 1 1/2-inch, cold-rolled channels shall be fastened in a manner to prevent stud rotation. Bridging shall be furnished as follows: walls up to 10 feet high, one row at mid-height; walls exceeding 10 feet high, bridging or bracing rows spaced not to exceed 5 feet on center.

9. Wind bracing shall be fastened where indicated on Drawings. Minimum size of strap shall be as indicated on Drawings. Track where strap terminates shall be anchored as indicated on Drawings.

B. Plaster Ceiling Suspension System:

1. Provide horizontal furring in accordance with CBC Section 2507.

2. Hanger Wires:

a. Hanger wires for ceilings suspended from wood frame construction shall be installed in accordance per DSA IR 25-1 and 25-4 and shall be fastened with stem lag screws in bottom edge of joists or rafters. Wire shall be looped through hole in stem lag screw and then wrapped twice around it. Stem lag screws shall be "Stanlag Screws" by Stanline, Inc., or equal, of type and penetration as follows:

Type Size	Hanger Wire	Screw Penetration, Minimum
Stanlag #SLS-3	#12 & #10 (0.104 and 0.128 inch diameter)	1 1/4-inch
Stanlag #SLS-375	#9 & #8 (0.144 and 0.160 inch diameter)	1 1/2-inch

b. Hanger wire shall be wrapped twice around runner channel, drawn up taut, and wrapped twice around itself.

3. Runner channels shall be installed 6 inches maximum from walls, parallel to runners. Splices in runner channels shall be provided at hangers only, by lapping channels not less than 12 inches and tying channels together at 2 points with a double wrap of tie wire twisted up taut.

4. Ends of runner channels abutting concrete or masonry surfaces shall be 1 ¼-inch clear and shall be tied to wall or partition with 3/4 inch channel brackets providing a 4-inch right angle bend secured with two 1/4 inch by 1 inch power-driven fasteners. Brackets shall extend from face of surface not less than 8 inches and shall be tied to runner channels at two points with double wrap of tie wire twisted up taut.

5. Securely saddle-tie furring channels to runner channels at each crossing with 16 gage (0.0538 inch diameter) tie wire twisted up taut, and with wings left uncut and bent back.

C. Gypsum Wallboard Ceiling Suspension and Framing: Suspended ceiling system framing shall be installed in accordance with ASTM C754, and as follows.

1. Hangers shall be spaced not more than 48 inches along runner channels and 36 inches in other direction or 42 inches in both directions unless otherwise indicated. Locations of hanger wires shall be coordinated with other Work. Hangers at ends of runner channels shall be located not more than 6 inches from walls. Hanger wire shall be fastened to structural elements with required fasteners. Sags or twists, which develop in suspended system, shall be adjusted. Damaged or faulty parts shall be replaced.

2. Main Runners: Hanger wires shall be double strand saddle-tied to runner channels and ends of hanger wire shall be twisted three times around itself. Main runners shall be located to within 6 inches of parallel wall to support ends of cross furring. Main runners shall not come in contact with abutting masonry or concrete walls. Where main runners are spliced, ends shall be overlapped 12 inches with flanges of channels interlocked, and shall be securely tied at each end of splice with wire looped twice around channels.

3. Furring channels shall be fastened to runner channels and to structural supports at each crossing with tie wire, hairpin clips, or required fastenings. Furring channels shall be located within 2 inches of parallel walls and beams, and shall be cut 1/2 inch short of abutting walls.

4. Ceiling Openings: Support members shall be provided as required at ceiling openings for access panels, recessed light fixtures, and air supply or exhaust. Support members shall be not less than 1 1/2-inch main runner channels and vertically installed suspension wires or straps shall be located to provide at least minimum support specified for furring and wallboard attachment. Intermediate structural members not a part of structural system, shall be provided for attachment or suspension of support members.

5. Light fixtures and air diffusers shall be supported directly from suspended ceiling runners. Wires shall be provided at required locations to support weight of recessed or surface mounted light fixtures and air diffusers.

6. Control Joints: Ceiling control joints for expansion and contraction shall be located where indicated on drawings. A control joint or intermediate blocking shall be installed where ceiling framing members change direction.

a. Interior Ceilings with Perimeter Relief: Control joints shall be installed so linear dimensions between control joints shall not exceed 50 feet in either direction or more than 2,500 square feet in area.

b. Interior Ceilings without Perimeter Relief: Control joints shall be installed so linear dimensions between control joints shall not exceed 30 feet in either direction nor more than 900 square feet in area.

D. Splay Wires and Compression Struts: Install as detailed and as required to prevent upward and sideward motion under seismic conditions, as required by code.

E. Suspension Under Ducts: For hangers spaced at 4 to 5 ½-foot centers, provide 6 gage (0.192 inch diameter) hanger wires with minimum 2 inch runner channels spaced at maximum 48 inch centers. For greater spans, design system for live load of l0 pounds per square foot of area plus dead load and provide a detail in Shop Drawings.

F. Furring: Provide framing for horizontal furring as shown or required. Conform to above requirements as applicable.

3.03 CONNECTIONS TO METAL DECKING

A. Provide pre-molded neoprene filler strips matching flute profile for non-fire-rated walls and partitions covered on one or both sides up to metal decking.

B. The top runner track of fire-rated partitions shall be a minimum of 20 gage (33 mils) and fastened to metal deck with required fasteners at spacing required for fire rating, but in no case over 16 inches on center. Neither wallboard nor metal studs shall be fastened to top runner to allow for slab deflection. Areas above runner shall be friction fit with a minimum depth of 2 1/2-inch of 4 pounds per cubic foot mineral wool insulation. A minimum of 1/2 inch of firestopping compound shall be installed to each side of mineral wool insulation for 1-hour system, and 1 inch of firestopping for a 2-hour system. Install required special tracks, angles, fasteners and strips of gypsum wallboard as required to achieve required fire resistance rating.

C. Proprietary fire-rated top tracks are installed in accordance with manufacturer's recommendations and fire rating approval requirements.

3.04 CLEANING

A. Remove debris, rubbish, and waste material and legally dispose of off Project site.

3.03 PROTECTION

A. Protect Work of this section until Substantial Completion.

END OF SECTION

SECTION 09 2423

CEMENT PLASTER AND METAL LATH

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Lath and Portland cement plaster and stucco.

2. Lath and scratch coat of Portland cement plaster as a substrate for ceramic wall tile.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 03 3000 – Cast-in-Place Concrete.

3. Section 06 1000 - Rough Carpentry.

4. Section 06 1643 – Gypsum Sheathing.

5. Section 07 2100 – Thermal Insulation.

6. Section 09 2216 - Non-Structural Metal Framing.

1.02 SYSTEM DESCRIPTION

A. Three coat 7/8” cement plaster with a fiberglass reinforcing mesh embedded into a polymer-modified base coat over the cured brown coat on metal lath over water resistive barrier over plastic sheet air barrier over sheathing over metal studs.

1.03 REFERENCES

A. ASTM International (ASTM):

1. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

2. ASTM A510 - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel.

3. ASTM A641 – Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

4. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

5. ASTM C150 – Standard Specification for Portland Cement.

6. ASTM C206 – Standard Specification for Finishing Hydrated Lime.

7. ASTM C841 - Standard Specification for Installation of Interior Lathing and Furring.

8. ASTM C847 - Standard Specification for Metal Lath.

9. ASTM C897 – Standard Specification for Aggregate for Job Mixed Portland Cement-Based Plasters.

10. ASTM C926 – Standard Specification for Application of Portland Cement-Based Plaster.

11. ASTM C932 - Standard Specification for Surface-Applied Bonding Compounds for Exterior Plastering.

12. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

13. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

14. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster.

15. ASTM C1116 – Standard Specification for Fiber-Reinforced Concrete.

16. ASTM E1190 – Standard Test Methods for Power-Actuated Fasteners Installed in Structural members.

B. Federal Specifications (FS):

1. FS FF-N-105: Nails, Brads, Staples and Spikes: Wire, Cut and Wrought.

2. UU-B-790A: Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent, and Fire Resistant).

C. International Code Council (ICC):

1. ICC-ES AC11: Acceptance Criteria for Cementitious Exterior Wall Coatings.

2. ICC-ES AC 191: Acceptance Criteria for Metal Plaster Bases (Lath).

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each material and component proposed for installation.

B. Plaster Samples: Submit minimum 48-inch by 48-inch samples of each stucco and Portland cement plaster texture for review. Samples shall be representative of texture, color, and proposed fabrication and finish quality. Maintain reviewed Samples on Project site for reference.

C. Accessories Samples: Submit 12 inch long samples of metal lath accessories: control joints, expansion joints, corner reinforcements, reveals and screeds.

D. Certificates: Submit test reports or ICC Evaluation Reports indicating that materials are in compliance with CBC requirements. Cementitious materials shall meet the acceptance requirements of ICC AC11, and metal lath the acceptance requirements of ICC AC191.

1.05 QUALITY ASSURANCE

A. Pre-Installation Conference: CONTRACTOR shall coordinate and conduct pre-installation conference, Project Meetings, to review the progress of construction activities and preparations for the installation of metal lath and cement plaster and other related work of this Section.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store weather sensitive materials under cover, off the ground, and kept in a dry condition until ready for use.

B. Deliver materials to the Project site in manufacturer's sealed and labeled packages.

PART 2 - PRODUCTS

2.01 METAL LATH AND WEATHER RESISTIVE BACKING

A. Metal Lath:

1. Walls and Ceilings: Diamond mesh expanded metal lath, in conformance to ASTM C847, without paper backing. 3.4 pounds per square yard, hot-dip galvanized coating G60 in accordance with ASTM A653. Alabama Metal Industries Corporation (AMICO), California Expanded Metal Products Company (CEMCO), ClarkDietrich, Marino-Ware, or equal.

a. 3.4 Expanded Metal Lath V-grooved self-furring type for installation over sheathing. Lath shall be furred out a minimum of 1/4 inch when installed over a solid surface in accordance to DSAIR 25-4.

b. Flat type for installation over open stud framing.

2. Walls: Self-furring Welded Wire Lath: Weight 1.95 pounds per square yard, with Class 1 galvanized coating in conformance to ASTM A641. Structa Mega Lath per ICC ESR-2017, as manufactured by Structa Wire Corp, or equal.

3. Walls & Ceilings: Self-furring Welded Wire Lath: Weight 2.2 pounds per square yard, with Class 1 galvanized coating in conformance to ASTM A641 with heavy perforated Kraft paper. V-Truss per ICC ESR-2017, as manufactured by Structa Wire Corp, or equal.

B. Water Resistive Barrier Backing for Metal Lath:

1. Two layer of asphalt saturated, water resistant Kraft paper backing conforming to Fed Spec UU-B-790A and ASTM E2556 Type II, manufactured by Fortifiber, Davis Wire, GMC Paper Products, or equal. Furnish for exterior plastering (except on soffits and ceilings), and for mortar-set ceramic wall tile.

C. Self-Adhered Flashing:

1. Compatible with the Plastic Sheet Air Barrier, minimum 25 mils thick, self-sealing and waterproof.

2. Adhesives, primers and sealers for self-adhered flashings and water repellant backing shall be as recommended by manufacturer for installation with specified products and substrates and shall be approved by the OWNER's Office of Environmental Health and Safety (OEHS).

2.02 METAL LATH ACCESSORIES

A. Materials: Minimum 0.0172 inch galvanized steel or 0.0207 zinc alloy with expanded wings. PVC is not permitted. Furnish casing beads, expansion and control joints, weep and vent screeds.

B. Manufacturers: Alabama Metal Industries Corporation (AMICO), California Expanded Metal Products Company (CEMCO), ClarkDietrich, Stockton Products, Marino-Ware, equal.

C. Products:

1. Exterior Stress Relief Joints: Sizes and profiles, indicated or required. Control joints shall have expanded wings when attachment flange is installed above the primary water-resistant barrier.

2. Expansion Joints: Two piece sections designed to accommodate expansion, contraction and shear forces. Industry generic name: M-Slide Expansion Joint 2 piece joint.

3. Control Joints: One-piece sections, with flange designed to engage plaster. Grounds shall provide full 7/8 inch thickness of cement plaster. Industry generic name: XJ-15.

4. Soffit Drip Screed: Similar to Stockton Products No. 5, with key holes.

5. Casing Beads: Expanded or standard flange type with 7/8 inch grounds to establish plaster thickness. Industry generic names: J-Mold or # 66.

6. Welded Wire Corner Reinforcement: 2-5/8 inch wire wings square or bullnose. Industry generic name: CornerAid.

7. Inner Corner Reinforcement: Shaped reinforcing expanded metal with 3 inch legs, for angle reinforcement. Industry generic name: Cornerite.

8. Lath Reinforcement: Flat expanded metal lath reinforcing units. Industry generic name: Striplath.

9. Outside Corner Reinforcing: 2 1/2" legs Class 1 Galvanized Coating complying with ASTM A641. VTruss Straight Corner per ICC ESR-2017, as manufactured by Structa Wire Corp, or equal.

10. Ventilating Screeds: Soffit, attic, fascia, edge, channel and expansion channel vent screeds, perforated web type, with integral plaster grounds, of sizes indicated on drawings.

11. Foundation Weep Screeds: Integral plaster ground and weep screed; 3-1/2" minimum attachment flange. Industry generic name: #7 Weep Screed.

2.03 LATH FASTENERS

A. Fasteners through Continuous Insulation: Fastener spacing as indicated on drawings.

1. Wood Studs: Fasteners shall be corrosion resistant screws in conformance to CBC Chapter 26.

2. Metal Studs: Corrosion resistant coated wafer head steel **[#8] [#10]** screws with length that penetrates framing steel thickness plus three threads minimum.

B. Fasteners at Locations with no Continuous Insulation:

1. Wood Studs: Fasteners shall be corrosion resistant.

a. Nails: In accordance to FS FF-N-105, 0.113 with a 3/8 inch diameter head with length that penetrates wood framing (exclusive of sheathing) 3/4 inch minimum.

b. Screws: Type A, in accordance to ASTM C1002, length that penetrates wood framing (exclusive of sheathing) 3/4 inch minimum.

c. Staples: In accordance to FS FF-N-105. Minimum 3/4 inch crown, 0.053 inch steel. Staples shall have sufficient length to penetrate studs at least 3/4 inch.

2. Metal Studs: Wafer head type S or S-12, corrosion resistant, with length to penetrate framing steel thickness plus three threads minimum.

a. Screws for fastening to steel members from 0.033 inch to 0.112 inch in thickness shall be in accordance to ASTM C954.

b. Screws for fastening to steel members 0.033 inch in thickness and less shall be in accordance to ASTM C1002.

C. Fasteners for Concrete and CMU Substrates: Power Actuated Fasteners: For attachment of lath to concrete and concrete masonry, recommended by manufacturer for the specific use intended. Minimum 3/4 inch long hardened drive style pin with a 1/2 inch diameter style washer. Fasteners shall be Fasteners shall be corrosion resistant and provide minimum withdrawal resistance of 50 pounds minimum.

D. Wire: Wire for fastening lath to supports, tying ends and edges of lath sheets, and securing accessories to lath, 0.0475 inch diameter (# 18 wire). Galvanized soft-annealed steel wire in conformance to ASTM A641.

2.04 PLASTER MATERIALS

A. Factory Blended Portland Cement Plaster Basecoats and Finish: Products as fabricated by California Stucco, La Habra, Parex, Shamrock Stucco, Merlex, Omega Stucco, Inc., , Spec Mix, Quikrete, CTS, Sika, or other manufacturer member of the Stucco Manufacturer's Association (SMA).

1. Material Standards: Shall conform to ASTM C926.

2. Three Coat Systems:

a. Scratch and Brown Coats: Factory blended fiber reinforced plaster and sand mix conforming to ASTM C926, and requiring only the addition of water. Total thickness of coats: 3/4 inch.

b. Finish Coat: Factory blended cementitious stucco color coat, integrally colored with fade-resistant pigments. Coat thickness 1/8 inch.

1) Finish: **Match existing.**

2) Color: Match existing.

B. Water: Clean, potable and from domestic source.

C. Plaster Bonding Agent: In conformance to ASTM C932 and formulated for exterior use. "Weld-Crete", manufactured by Larsen Products Co., or equal.

D. Bonding Agent: 100% acrylic emulsion additive, Parex USA Adacryl Admix & Bonder or equal.

E. Flashing: Single ply self-adhesive waterproofing membrane as manufactured by W.R. Grace Company, Jiffy-Seal by Protecto Wrap, W.R. Meadows, Inc., or equal. Furnish for installation behind stress relief joints and backing on horizontal and vertical surfaces exposed to weather; under metal copings and flashings; and window jambs and sills.

F. Continuous Insulation: Refer to Section 07 2100, Thermal Insulation.

G. Miscellaneous Materials: Provide additional components and materials required for a complete installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that installation of plastic sheet air barrier and flashings, per Section 07 2719, and continuous insulation per Section 07 2100 are complete before starting Work of this Section.

3.02 INSTALLATION-OF WATER RESISTIVE BARRIER

A. Install two layers of water resistant barrier. Install Kraft paper horizontally with each course weather lapped 2 inches over layer below and 6 inches on ends.

B. Repair and seal tears and holes in water resistive barrier prior to installing lath.

C. Install single ply self-adhesive flashing per manufacturer‘s recommendations in areas indicated on the Drawings and at locations where the plaster will be in less than a 60 degree plane or where water can pond, with a six inches extension onto the vertical wall surface. Apply self-adhesive flashing in a “shingle fashion”.

3.03 INSTALLATION OF LATH AND LATH ACCESSORIES

A. Exterior Lathing, General: Install in conformance to ASTM C1063 and CBC Chapter 25.

B. Install longest length of metal lath as possible. Do not use pieces shorter than six feet in length. Attach lath to framing supports not more than seven (7) inches apart along framing supports only.

C. Apply metal lath with long dimension at right angles to framing or furring supports and lap lath a minimum 1/2 inch at sides and minimum 1 inch on ends. Lap wire lath minimum one mesh on sides and ends. Stagger vertical laps at least 16 inches. Lath shall lap flanges of solid flanged trim accessories by a minimum of 50%.

D. Ends of lath on open framing (unsheathed) shall occur over supports. Where necessary, install additional studs to provide support for lath ends and support for separate flanges of stress relief joints.

E. Install trim accessories plumb, level and straight, attachments should not exceed 24 inches on center.

F. Lath shall not be continuous through control joints. Two-piece Expansion Joints shall have the lath cut, be attached to framing and lath lap the flanges. Place control joints as indicated on elevations. Water resistant barrier shall be continuous behind all control joints and vertical reveals.

G. Install a weep screed at or below foundation plate line on exterior stud walls in conformance to CBC section 2512. Screed shall be of a type permitting water to drain to exterior of building. Weather-resistant barrier and exterior lath shall cover and terminate on attachment flange of screed.

H. Powder Actuated Fasteners shall be used on concrete/masonry substrates when lath is applied. Fasteners shall be driven home and avoid spalling of concrete. Pattern shall simulate that of framed walls.

I. Interior Lathing, General: Install in conformance to ASTM C841 and CBC Chapter 25.

J. Metal lath shall be fastened to metal supports with specified fastener spaced not more than 6 inches apart or with other recognized fasteners.

3.05 PLASTER APPLICATION - GENERAL

A. Verify that installation of lath is complete prior to start plastering. Notify the Technical Service Information Bureau upon completion of lath and prior to start of plaster to schedule a lathing installation compliance meeting. TSIB will submit a written field observation report delineating any deficiencies. Site meeting shall be coordinated with OAR.

B. Proportion, mix, apply, and cure plaster in conformance with ASTM C926 and CBC Chapter 25.

C. Install each plaster coat to an entire wall or ceiling panel without interruption to avoid cold joints and abrupt changes in uniform appearance of succeeding coats. Wet plaster shall abut existing plaster at naturally occurring interruptions in plane of plaster (such as corner angles, openings and control joints) wherever possible. Cut joining, where necessary, square and straight and at least 6 inches away from a joining in preceding coat.

D. Provide sufficient moisture or curing methods to permit continuous and complete hydration of cementitious materials, considering climatic and Project site conditions. If water cured, each basecoat shall be continuously damp for at least 48 hours, including weekends and holidays. Other curing methods, spray applied curing compounds, or OEHS approved equal are permitted.

E. Provide sufficient time between coats to permit each coat to cure or develop enough rigidity to resist cracking or other damage when next coat is installed.

3.06 EXTERIOR PLASTERING

A. Concrete surfaces, except where noted as "Exposed Concrete" or "Painted Concrete," shall be finished with stucco finish coats, as specified.

B. Preparation of Concrete and Masonry Surfaces:

1. Exterior concrete and masonry surfaces to be plastered shall be free of oily or waxy substances, and loose or foreign material. Uniformly spray with nozzle-

type water spray at least 12 hours before installation of plaster or as required to control suction.

2. Concrete and masonry surfaces to receive two coat application of 5/8 inch thick Portland cement plaster shall be treated with bonding agent. This surface preparation shall not be installed instead of a brown coat of plaster.

3. Concrete surfaces to receive stucco dash finish shall be lightly sandblasted to provide a roughened surface.

4. Verify that lath has been installed securely and that grounds, screeds, casing beads and other accessories are straight, in correct position, and securely fastened in place.

C. Mixing: Provide plaster mix: cementitious materials and aggregate in proportions specified, furnishing only sufficient water to obtain proper consistency before installation. Do not mix any more material at any time than can be installed within 1/2 hour after mixing. Do not re-temper. Add only enough water to allow proper application of cement plaster.

D. Application:

1. Bond Coat: on concrete or masonry surfaces, leave undisturbed, and maintain damp for at least 24 hours following installation. Dash bond coat may be omitted when liquid bonding agent is used.

2. Scratch Coat: Install with sufficient material to completely cover laths and scratch across supports.

3. Brown Coat: Rod to a straight, true, even within 1/4 inch tolerance in 5 feet of surface and consolidate surface with a wood or neoprene float. Surface shall be left open and course, suitable to receive finish coat.

4. Stucco Finish Coat: Install in two coats to a total thickness of 1/8 inch, each coat covering surface uniformly. First coat shall completely cover basecoat with uniform color. Second color shall provide a uniform texture.

a. First finish coat shall be installed adequately to cover surface and fill minor imperfection in the brown coat.

b. The second coat shall be installed by doubling back same day, when first coat is sufficiently dry.

c. Over concrete surfaces, second coat shall be installed 24 hours after installation of first coat. In warm weather, first coat shall be cured by light water spray after material has set.

d. Protection: Protect those surfaces, which are not to receive dash finish coats. Such surfaces shall be shielded and shall have any sand left from dashing operation removed.

e. Provide smoothed plaster finish to comply with ADA requirements behind handrails.

E. Curing Exterior Plaster: Adhere to current edition of CBC for curing requirements.

F. Option for Machine Application, Scratch and Brown Coats: Instead of hand installed plaster, the furnishing of plastering machines for interior or exterior scratch and brown coats or single base coat is permitted. Machine installation shall be in accordance with the following:

1. Qualifications: Provide proper equipment and apparatus.

2. Apparatus: Pump shall be equipped with an air pressure gage or factory installed blow-off valve and required safety devices. Hoses and connections shall be tight and pressure shall be maintained constant.

3. Proportion and Application: Proportioning, mixing, number of coats and thickness shall be same as specified for hand application. Cement aggregate and water shall be mixed to plaster machine. Plaster mix shall be projected into and conveyed through a hose to the nozzle at end of hose and deposited by pressure in its final position ready for manual straightening and finishing.

4. Follow-Up: Perform scoring operation of plaster, based on settings and drying conditions at time of installation. Curing shall be as previously specified.

5. Protection: Before installing any plaster, thoroughly protect other adjacent Work.

3.07 INTERIOR PLASTERING

A. Portland Cement Plaster, Scratch Coat: Install to vertical lathed surfaces where ceramic tile is indicated, and install Portland cement plaster finishes where indicated.

B. Preparation for Plastering:

1. Verify that lath has been installed securely and that grounds, screeds, casing beads and other accessories are straight, in correct position, and securely fastened in place.

2. Bonding Agent: Install to vertical concrete or masonry surfaces to receive ceramic tile.

3. Concrete and masonry surfaces on which suction must be reduced shall be sufficiently moistened before plastering operations start.

4. Install galvanized expanded metal lath on supports in conformance with requirements of ASTM C1063 and CBC.

C. Number of Coats and Thickness: Interior plastering to receive paint shall consist of the following, with thickness measured from face of supports or surface:

1. On Concrete or Masonry: two coats, brown and finish, 5/8 inch thick.

2. On Metal Lath: three coats, scratch, brown and finish 7/8 inch thick.

D. Proportions for Interior Plaster: Adhere to current edition of CBC for proportions and curing requirements.

1. Admixtures shall be proportioned, mixed and installed in accordance with printed directions of manufacturer.

E. Mix factory blended plaster using only sufficient water to obtain proper consistency before installation. Do not mix any more material at any time than can be installed within ½ hour after mixing. Do not allow material to remain in mixer or mixing boxes overnight.

F. Application:

1. Dash Bond Coat: Dash on surface, leave undisturbed, and maintain damp at least 24 hours following installation. Omit Dash bond coat when liquid bonding agent is used.

2. Scratch Coat: Install with sufficient material to form good keys, thoroughly cover lath, and cross scratch.

3. Brown Coat: Rod to a straight, true and even surface. Brown coat must be 1/16 inch below face of grounds to provide adequate space for finish coat. Float surface to increase density.

4. Smooth Finishes: Install two coats for a thickness of 1/8 inch. Install second coat after finish coat begins to set. Install to a true, even plane and trowel to a smooth finish, free from blemishes.

5. Float Finishes: Install to a thickness between 1/16 inch to 1/8 inch, install and uniformly float to true planes.

6. Plaster Screeds: On metal lath or wire fabric lath, install plaster screeds wherever permanent grounds are too far apart to serve as guides for rodding.

G. Curing Interior Plaster: Adhere to requirements of CBC.

3.08 QUALITY CONTROL

A. Finish interior and exterior plaster to a uniform texture, free of imperfections and flat within 1/4 inch in 5 feet. Form a suitable foundation for paint and other finishing materials. Avoid joining marks in finish coats.

3.09 REPAIR OF DAMAGED PLASTER

A. Plaster Detached from Framing:

1. Remove loose and broken plaster.

2. Repair or replace damaged water-resistant backing and lath in compliance with specified standards.

3. Remove stucco finish from surrounding area in the same plane by sandblasting.

4. Install a scratch coat and a brown coat mixed with liquid bonding agent instead of water to the areas devoid of plaster.

5. Install a coat of liquid bonding agent to entire wall plane.

6. Install a 1/8 inch thick stucco finish coat to entire wall plane and match existing texture and color.

B. Cracked Plaster 1/8 inch to 1/2 inch:

1. Remove loose material from crack with a wire brush.

2. Fill crack with slurry of stucco and liquid bonding agent.

3. Install a coat of liquid bonding agent to entire wall plane.

4. Install 1/8 inch thick stucco finish to entire wall plane and match existing texture and color.

C. Cracks Larger than ½ inch - Painted:

1. Remove loose material from crack with a wire brush.

2. Fill crack with slurry of one part Portland cement to three parts masonry or stucco sand and liquid bonding agent to match existing texture of adjacent surface.

3. Paint entire wall plane, color to match existing.

4. Where patching of plaster over existing lath is feasible, fasten loose lath and install new lath with nails at 6 inch centers. Where metal is furnished, lap new lath over existing 6 inches and tie at 6 inch centers. Install paper backings as required, shingled into existing.

5. Patching of Holes, Cracks, and Gouges: Holes, cracks, gouges, missing sections, and other defects in existing improvements shall be patched. For holes over 1 inch in size, cut small sections of lath and place in opening attached to existing material. Install 3 coats of plaster. For holes one inch and smaller, install bonding agent to existing surfaces and neatly fill hole with plaster, installing necessary coats to match adjacent surfaces, eliminate cracks and match existing surface texture. Cracks, gouges, and other defects shall be filled with plaster or spackle as required and neatly finished to match adjacent existing improvements.

3.10 CLEANING

A. Remove rubbish, debris, and waste material and legally dispose of off the Project site.

3.11 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 09 2900

GYPSUM BOARD

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Gypsum board wall and ceiling systems.
2. Gypsum Liner.
3. Cement Tile Backer Board.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 06 1000 - Rough Carpentry.
3. Section 07 9200 - Joint Sealants.
4. Section 09 2216 - Non-Structural Metal Framing.
5. 09 9000 Painting Coating.

1.02 PROJECT REQUIREMENTS

A. Design Requirements: Provide systems capable of resisting deflection as required by CBC and authorities having jurisdiction.

B. Regulatory Requirements: Comply with CBC requirements for design and installation.

1.03 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings indicating complete suspension system including connections, anchorage, and trim features.

B. Material Samples: Submit 18 inch by 18 inch Samples of the texture coat of gypsum board panels with edges taped.

C. Product Data: Submit manufacturer's catalog data for each product proposed for installation.

1.04 QUALITY ASSURANCE

A. Comply with following as a minimum requirement:

1. ASTM C475 – Standard Specification for Joint Compound and Joint Tape for finishing Gypsum Board.

2. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.

3. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.

4. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

5. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

6. ASTM C1325 - Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units.

7. ASTM C1396 - Standard Specification for Gypsum Board.

8. ASTM C1629 - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.

9. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

10. ASTM D3274 – Standard Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation.

11. Underwriters Laboratories (ULI) requirements and listings for fire-rated materials and products classification.

12. GA 214 - Gypsum wallboard finish shall conform to requirements of GA 214, Application and Finishing of Gypsum Panel Products, published by the Gypsum Association, and as specified herein.

13. GA 600 - Gypsum wallboard shall conform to requirements of GA 600 Fire Resistance Design Manual, published by the Gypsum Association.

14. American National Standards for the Installation of Ceramic Tile.

15. ANSI A118.9 - Specification for Cementitious Backer Units.

B. Qualifications: Installer shall have a minimum 5 years experience in installing and finishing gypsum board.

C. CHPS Low-Emitting Materials table: Materials submitted must meet the CHPS Low-Emitting criteria and be listed as Low-Emitting on the following web site: www.CHPS.net or be listed on UL website Greenguard.org as Greenguard Gold Certified

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, factory sealed packages, containers or bundles bearing brand name and name of manufacturer.

B. Materials shall be kept dry. Gypsum wallboard shall be neatly stacked flat; avoid sagging and damage to edges, ends, and surfaces.

C. Fire-rated materials shall have fire classifications numbers attached and legible.

D. Provide all means necessary to protect gypsum board systems before, during, and after installation.

E. Gypsum wallboard showing any evidence of water damage shall not be installed. Gypsum wallboard showing evidence of water damage after installation shall be removed and replaced.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Georgia-Pacific.

B. National Gypsum Co.

C. U.S. Gypsum Co.

D. Or equal.

2.02 MATERIALS

A. Mold and Water Resistant Gypsum Board, Type X (fire-resistant): 5/8 inch thick 4-foot wide, up to 16-foot long conforming to ASTM C1396 with long edges tapered.

1. Resistance to Mold Growth: Minimum score of "10" when tested in accordance to ASTM D3273 and evaluated in accordance with ASTM D3274.

2.03 ACCESSORIES

A. Metal Trim: Paper-faced metal drywall beads and trim meeting ASTM C1047, as manufactured by USG/Beadex, or equal. Trim units shall be of size and type to fit gypsum board construction and shall include corner beads, casings, edge trim and other shapes indicated and required. Provide 30 year warranty against edge cracking.

B. Joint Compound for gypsum board products: meeting the following requirements:

1. Shall conform to ASTM C475.

2. In areas subject to moisture after installation such as bathrooms and locker areas use setting type joint compound.

3. Interior areas not subject to moisture after installation use drying Type Joint compound.

C. Joint Tapes for gypsum boards: Shall conform to ASTM C475.

D. Finishing Materials: Texture coat finish material shall be manufactured by U.S. Gypsum, Hamilton, or Highland Stucco and Lime Products, Inc., or equal.

E. Acoustical Sealant: Non-hardening, non-shrinking, for use in conjunction with gypsum board, as recommended by Board Manufacturer and conforming to ASTM C919. Sealant shall maintain fire and sound rating assembly.

F. Fasteners:

1. Self-drilling, self-tapping bugle-head drywall screws; in conformance to ASTM C1002. No. 6 Type S or S12, 1 5/8-inch long for metal framing,

2. Wood framing: Screws: Type W 1 5/8-inch minimum length for single-layer panels. Screws shall be furnished with a corrosion-resistant treatment.

3. Adhesive: as recommended by board manufacturer and in compliance to ASTM C557.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Metal Trim:

1. Provide corner beads at outside corners and angles, metal casing where gypsum board terminates at uncased openings, metal edge trim where board edges abut horizontal and vertical surfaces of other construction.

2. Install trim in accordance with manufacturer's directions with appropriate joint compound. Install trim in longest practical pieces.

B. Gypsum Board:

1. Install gypsum board in conformance with ASTM C840, fire rated design, and sound rating.

2. Gypsum board shall be cut by scoring and breaking or by sawing, working from face side. Where board meets projecting surfaces it shall be scribed and neatly cut. Unless conditions require otherwise, gypsum board shall be installed first to ceilings, then to walls. End joints shall occur over a support. Install panels of maximum practical length so a minimum number of end joints occur.

3. End joints shall be staggered and joints on opposite sides of a partition shall be arranged to occur on different studs. Joint layout at openings shall be installed so no end joints will align with edges of openings.

4. Except where specified otherwise, fasteners shall be spaced not less than 3/8 inch from edges and ends of gypsum board. Do not stagger fasteners at adjoining edges and ends.

5. Install gypsum board vertically or horizontal as permitted by specific UL Design at walls. Fasten board with drywall screws spaced not to exceed 8

inches on centers around perimeter of boards and 8 inches on centers on intermediate studs. Space screws at 8 inches on centers along top and bottom runners. Screws shall be driven to provide screwhead penetration just below gypsum board surface without breaking surface paper. Where electrical outlet and switch boxes are indicated, provide adjustable attachment brackets between studs.

6. Install gypsum board to ceiling framing with long dimension at right angles to furring channels, or wood framing members, and fasten with specified drywall screws or nails spaced 6 inches to 7 inches on centers across board. Screws or nails shall be not less than 1/2 inch from side joints and 3/8 inch from butt end joints. Abutting end joints shall occur over furring channels and end joints of boards shall be staggered. Support cutouts or openings in ceilings with furring channels.

7. Install access doors, furnished under another section, in correct location, plumb, or level, flush with adjacent construction, and securely fastened to framing.

C. Cement Board Backer System:

1. In shower areas, install water barrier in shingle-like manner to prevent water infiltration into stud cavity. Pre-cut all board to required sizes and make necessary cut-outs.

2. Install cement board in accordance with UL Design and SA-932. Install Cement board plumb and flat. Shim behind board as required.

3. Fasten cement board to steel studs spaced max. 16" o.c. and bottom runners with cement board fasteners spaced 8" o.c. maximum with perimeter fasteners at least 3/8" and less than 5/8" from ends and edges. Studs shall be not less than 20 gage.

4. Tape joints with cement board tape and joint mortar. Finished surface shall be level within 1/8" in 10".

3.02 TOLERANCES

A. System shall appear flat and monolithic with no exposed joints.

3.03 JOINT TREATMENT AND FINISHING

At completion of specified taping and finishing, install one coat of drywall primer as specified hereafter.

B. Levels: Install tape bedding compound, tape, and finishing cement on joints in wallboard as required for specified levels of finish.

C. Levels 2 through 5:

1. Install joint cement and finishing cement over screw heads. Treat all inside corners with joint cement, tape, and finishing cement. Treat outside corners with corner beads and finishing cement.

2. Provide metal casing beads at all edges of gypsum wallboard, which abut ceiling, wall, or column finish, and elsewhere as required, such as openings, offsets, etc. Install all exposed joints, trims, and attachments non-apparent following installation of paint or other finishes. If joints and fasteners are visibly apparent, correct defects as required.

3. Seal raw edges of plumbing openings and boards that have been cut to fit with sealing compound brushed on.

4. When entire installation is completed, correct and repair broken, dented, scratched or damaged wallboard before installation of finish materials by other trades.

D. Levels 3 and 4: Install one coat of drywall primer over entire surface prior to painting.

E. Level 5: Install one coat of skim coat over entire surface, followed by one coat of drywall primer over entire surface prior to painting.

3.04 REQUIRED LEVELS OF FINISH

A. Finishes shall conform to GA 214

B. Unless otherwise indicated or specified, levels of finish required shall be as follows:

1. Level 1: Plenum areas above ceilings, insides of shafts, and other concealed areas. Taping to be as required for fire rated assemblies.

2. Level 2: Water-resistant wallboard backing for high moisture areas to be covered with a water resistant surface other than tile, vinyl or paint, i.e stainless steel cladding etc.

3. Level 3: Backing for vinyl wall covering and adhered acoustic tile. Also, provide where textured finish is indicated.

4. Level 4: Exposed painted wallboard in classrooms, utility rooms, and similar spaces not requiring Level 5 finish.

5. Level 5: Exposed, painted wallboard in offices and corridors.

3.06 CLEAN-UP

A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

3.07 PROTECTION

A. Protect Work of this section until Substantial Completion.

END OF SECTION

SECTION 096723 – RESINOUS FLOORING

PART 1 - GENERAL

1.1 Summary
- A. This Section includes:
  1. High-performance resinous flooring systems.

1.2 Submittals
- A. Product Data: For each type of product indicated.
  1. Data must state that moisture testing is not required
- B. Installer Certificates for Qualification: Signed by manufacturer certifying that installers comply with specified requirements.
- C. Material Certificates: For each resinous flooring component, from manufacturer.
- D. Material Test Reports: For each resinous flooring system.
- E. Maintenance Data: For maintenance manuals.
- F. Samples: Submit one sample of coating, indicating coating applied on horizontal surfaces. Sample shall illustrate transition from Resinous Flooring system. Provide sample which is a true representation of proposed field applied finish-created by the contractor; not laboratory applied finish. Provide minimum 12 feet by 4 feet field sample color and four (4) texture options for owner approval as a mock up at location designated by General Contractor for review and written approval prior to installation of any other areas.
- G. Product Schedule: For resinous flooring.

1.3 Quality Assurance
- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.
  1. Engage an installer who is approved in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
  2. Installer Letter of Certification: Installer to provide letter stating that they have been in business for at least 10 years and listing 5 projects in the last 2 years of similar scope. For each project provide: project name, location, date of installation, contact information, size of project, and manufacturer of materials with system information.
- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
- C. Pre-installation Conference: Conduct conference at Project site before work and mockups begin.

D. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Apply full-thickness mockups on 48-inch square floor area selected by Architect.
   2. Simulate finished lighting conditions for Architect's review of mockups.
   3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
   4. Mockup shall demonstrate desired slip resistance for review and approval by General Contractor prior to installing project areas.

1.4 Delivery, Storage, And Handling

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.5 Project Conditions

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Basis of Design for (**RF)** High-Performance Resinous Flooring: Sherwin Williams Company.
   1. FasTop Multi Topfloor SL45, moisture insensitive high performance floor coating system.
      a. 1st Coat: 2-part primer epoxy 3477
      b. 2nd Coat: FasTop Multi Topfloor SL45, broadcasted with 20/40 mesh silica.
      c. 3rd Coat: Grout, Resuflor 3746 two-component epoxy, 15 mils.
      d. 4th Coat: Topcoat, Resuflor 3746 two-component epoxy, 8 mils.
      e. Total System Thickness 1/4” nominal.
B. Or Equal.

2.2 Materials

A. VOC Content of Resinous Flooring: Provide resinous flooring systems, for use inside the weatherproofing system, that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24)].

1. Resinous Flooring: 100 g/L.

2.3 High-Performance Resinous Flooring

A. Resinous Flooring: Abrasion-, impact- and chemical-resistant, high-performance, resin-based, monolithic floor surfacing designed to produce a seamless floor.

B. System Characteristics:

1. Color and Pattern: As indicated from manufacturers listed above.
2. Slip Resistance: As needed

PART 3 - EXECUTION

3.1 Preparation

A. Inspection: Prior to commencing Work, thoroughly examine all underlying and adjoining work, surfaces and conditions upon which Work is in any way dependent for perfect results. Report all conditions which affect Work. No "waiver of responsibility" for incomplete, inadequate or defective underlaying and adjoining work, surfaces and conditions will be considered, unless notice of such unsatisfactory conditions has been filed and agreed to in writing before Work begins. Commencement of Work constitutes acceptance of surfaces.

B. USE ONLY MOISTURE INSENSITVE SYSTEMS, that require no moisture testing and warrantied by manufacturer. No systems allowed that require moisture testing.

C. Only installers approved by the manufacturer in writing shall perform installation of the material.

D. Surface Preparation: Remove all surface contamination, loose or weakly adherent particles, laitance, grease, oil, curing compounds, paint, dust and debris by blast track method or approved mechanical means (acid etch not allowed). If surface is questionable try a test patch. Create a minimum surface profile for the system specified in accordance with the methods described in ICRI No. 03732 to achieve CSP 4.

3.2 Environmental Conditions

A. All applicators and all other personnel in the area of the RF installation shall take all required and necessary safety precautions. All manufacturers' installation instructions shall be implicitly instructions shall be implicitly followed.

B. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.

C. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
E. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
F. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

3.3 Applications

A. Install resinous floor over properly prepared concrete surface in strict accordance with the manufacturer's directions.
   1. Install the primer and/or base coats over thoroughly cleaned and prepared concrete.
   2. Install topcoat over flooring after excess aggregate has been removed.
   3. Maintain a slab temperature of 60°F to 80°F for 24 hours minimum before applying floor topping.
B. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
   1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
   2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
   3. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
C. Sealant: Saw cut resinous floor topping at expansion joints in concrete slab. Fill sawcuts with sealant prior to final seal coat application. Follow manufacturer’s written recommendations.
D. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
E. Slip Resistant Finish: Provide grit for slip resistance.
F. Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.4 Completed Work

A. Cleaning: Upon completion of the Work, clean up and remove from the premises surplus materials, tools, appliances, empty cans, cartons and rubbish resulting from the Work. Clean off all spatterings and drippings, and all resulting stains.
B. Protection: Protect Work in accordance with manufacturer's directions from damage and wear during the remainder of the construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.
C. Contractor shall insure that coating is protected from any traffic until it is fully cured to the satisfaction of the coating manufacturer.

END OF SECTION 096723

SECTION 09 9000

PAINTING AND COATING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior and exterior painting.

B. Following items shall not be painted:

1. Brass valves, chromium or nickel-plated piping and fittings.

2. Boiler control panels and control systems.

3. Fabric connections to fans.

4. Flexible conduit connections to equipment, miscellaneous name plates, stamping, and instruction labels and manufacturer's data.

5. Mechanical and electrical utility lines, piping and heating and ventilation ductwork in tunnels, under-floor excavated areas or crawl spaces, attic spaces and enclosed utility spaces.

6. Flag, floodlight, parking light poles and loudspeaker poles, metal stairs, handrails and chain-link fence with a galvanized finish, unless otherwise noted.

7. Structural and miscellaneous steel, open web steel joists and metal floor decking, which will not be exposed in final construction, shall have no finish other than one coat of shop primer.

8. Hardboard covering on tops and backs of counters and benches.

9. Brass, bronze, aluminum, lead, stainless steel and chrome or nickel-plated surfaces.

10. Non-metallic walking surfaces unless specifically shown or specified to be painted.

1.02 REGULATORY REQUIREMENTS

A. Paint materials shall comply with the Food and Drug Administration’s (F.D.A.) Lead Law and the current rules and regulations of local, state and federal agencies governing the use of paint materials.

1.03 SUBMITTALS

A. List of Materials: Before submittal of samples, submit a complete list of proposed paint materials, identifying each material by distributor's name, manufacturer's name, product name and number, including primers, thinners, and coloring agents, together with manufacturers' catalog data fully describing each material as to contents, recommended installation, and preparation methods. Identify surfaces to receive various paint materials.

B. Material Samples: Submit manufacturer's standard colors samples for each type of paint specified. Once colors have been selected, submit Samples of each color selected for each type of paint accordingly:

1. Samples of Paint and Enamel must be submitted on standard 8 ½" x 11" Leneta Opacity-Display Charts. Each display chart shall have the color in full coverage. The sample shall be prepared from the material to be installed on the Work. Identify the school on which the paint is to be installed, the batch number, the color number, the type of material, and the name of the manufacturer.

2. Elastomeric shall be submitted in duplicate samples of the texture coating. Samples will be not less than 2 ½ by 3 ½ in size and installed upon backing. Finished Work will match the reviewed Sample in texture.

3. Materials and color samples shall be reviewed before starting any painting.

C. For transparent and stained finishes, prepare samples on same species and quality of wood to be installed in the Work, with written description of system used.

1.04 QUALITY ASSURANCE

A. Certification of Materials: With every delivery of paint materials, the manufacturer shall provide written certification the materials comply with the requirements of this section.

B. Coats: The number of coats specified is the minimum number. If full coverage is not obtained with the specified number of coats, install additional coats as required to provide the required finish.

C. Install coats and undercoats for finishes in strict accordance with the recommendations of the paint manufacturer as reviewed by the Architect.

D. Paint materials shall comply with the following as a minimum requirement:

1. Materials shall be delivered to Project site in original unbroken containers bearing manufacturer's name, brand number and batch number.

2. Open and mix ingredients on premises in presence of the Project Inspector.

1.05 DELIVERY, STORAGE AND HANDLING

A. Storage and Mixing of Materials: Store materials and mix only in spaces suitable for such purposes. Maintain spaces clean and provide necessary precautions to prevent fire. Store paint containers so the manufacturer's labels are clearly displayed.

1.06 SITE CONDITIONS

A. Temperature: Do not install exterior paint in damp, rainy weather or until surface has thoroughly dried from effects of such weather. Do not install paint, interior, or exterior, when temperature is below 50 degrees F, or above 90 degrees F, or dust conditions are unfavorable for installation.

1.07 WARRANTY

A. Manufacturer shall provide a three year material warranty.

B. Installer shall provide a three year application warranty.

1.08 MAINTENANCE

A. Provide at least one gallon of each type, color and sheen of paint coating installed. Label containers with color designation indicated on Drawings.

PART 2 - PRODUCTS

2.01 PAINT MATERIALS

A. Furnish the products of only one paint manufacturer unless otherwise specified or required. Primers, intermediate and finish coats of each painting system must all be the products of the same manufacturer, including thinners and coloring agents, except for materials furnished with shop prime coat by other trades.

B. Factory mix paint materials to correct color, gloss, and consistency for installation to the maximum extent feasible.

C. Paint materials to be minimum “Architectural Grade”.

D. Gloss degree standards shall be as follows:

HIGH GLOSS	70 and above	EGGSHELL	30 to 47
SEMI-GLOSS	48 to 69	SATIN	15 to 29

2.02 MANUFACTURERS

A. Acceptable manufacturers, unless otherwise noted:

1. Dunn-Edwards Corporation Paints

2. Frazee Paints and Wall coverings

3. Vista Paints

4. Sherwin Williams

5. ICI Paints

6. Equal.

PART 3 - EXECUTION

3.01 PREPARATION

A. Examine surfaces to receive paint finish. Surfaces which are not properly prepared and cleaned or which are not in condition to receive the finish specified shall be corrected before prime coat is installed.

B. New woodwork shall be thoroughly cleaned, hand sandpapered, and dusted off. Nail holes, cracks or defects in Work shall be filled. On stained woodwork, fill shall be colored to match stain. Filling shall be performed after the first coat of paint, shellac or varnish has been installed.

C. Plaster surfaces except veneer plaster shall be allowed to dry at least 3 weeks before painting. Veneer plaster shall be allowed to dry sufficiently to receive paint as determined by moisture meter tests.

D. Metal surfaces to be painted shall be thoroughly cleaned of rust, corrosion, oil, foreign materials, blisters, and loose paint.

E. Do not install painting materials to wet, damp, dusty, dirty, finger marked, rough, unfinished or defective surfaces.

F. Concrete surfaces shall be dry, cleaned of dirt and foreign materials and in proper condition to receive paint. Neutralize spots demonstrating effects of alkali.

G. Mask off areas where necessary.

3.02 APPLICATION

A. Backpainting: Immediately upon delivery to the Project site, finish lumber and millwork shall be backpainted on surfaces that will be concealed after installation. Items to be painted shall be backpainted with priming coat specified under "Priming".

B. Priming: New wood and metal surfaces specified to receive paint finish shall be primed. Surfaces of miscellaneous metal and steel not embedded in concrete, and surfaces of unprimed plain sheet metal Work shall be primed immediately upon delivery to the Project site. Galvanized metal Work and interior and exterior woodwork shall be primed immediately after installation. Priming of surfaces and priming coat shall be as follows:

1. Knots, Pitch and Sap Pockets: Shellac before priming.

2. Exterior Woodwork and Wood Doors: Prime with one coat of exterior waterborne emulsion wood primer.

3. Interior Woodwork: Where indicated to be painted, prime with one coat of waterborne wood primer.

4. Stain: Woodwork indicated to receive a stain and varnish finish shall be stained to an even color with water borne stain. On open-grained hardwood, mix stain with paste filler and completely fill pores in wood.

5. Galvanized Metal Work: Clean oil, grease and other foreign materials from surfaces. Install vinyl wash pretreatment coating. Follow manufacturer's instructions for drying time, and then prime with one coat of metal primer.

6. Unprimed Iron, Steel, and Other Uncoated Metals: Where specified to be painted, prime with one coat of metal primer.

7. Shop Primed Metal Items: Touch up bare and abraded areas with metal primer before installation of second and third coats.

8. Coats shall be installed evenly and with full coverage. Finished surfaces shall be free of sags, runs and other imperfections.

C. Allow at least 24 hours between coats of paint.

D. Rollers shall not be used on wood surfaces.

E. Each coat of painted woodwork and metal, except last coat, shall be sandpapered smooth when dry. Texture-coated gypsum board shall be sanded lightly to remove surface imperfections after first coat of paint has been installed.

F. Each coat of paint or enamel shall be a slightly different tint as required. Each coat of paint, enamel, stain, shellac, and varnish will be inspected by the IOR before next coat is applied. Notify the Project Inspector that such Work is ready for inspection.

1. Tinting Guideline: The first coat, primer/undercoat(s) to be untinted or tinted up to 50 percent lighter or darker (at the discretion of the installer) than the finish coat. The second coat (or third coat if a seal coat and undercoat have been specified) is to be factory tinted in the range of 10 percent to 15 percent lighter or darker (at the discretion of the installer) than the finish coat. The final coat is to be factory tinted to the required color selected. These tinting guidelines shall be provided on all surfaces receiving paint.

G. Do not "paint-out" UL labels, fusible links and identification stamps.

H. Paint Roller, brush and spray.

1. Only Paint rollers shall be used on interior plaster, drywall, masonry/plaster and plywood surfaces, nap shall not exceed one half inch in length.

2. First coat on wood overhang and ceilings shall have material applied by roller and then brushed out in a professional manner to leave surface free of imperfections. Finish coat may be sprayed.

3. Other surfaces shall have all coatings applied with brushes of proper size.

4. Spray work is permitted only on radiators, acoustic plaster, masonry and plaster.

I. Where ceilings are specified to be painted, beams, cornices, coves, ornamental features, plaster grilles, etc. shall be included.

J. Ceilings shall be white, including classrooms, storage rooms, offices, arcades, etc. Boiler room and fan room ceiling color shall match adjacent walls.

3.03 CLEANING

A. Remove rubbish, waste, and surplus material and clean woodwork, hardware, floors, and other adjacent Work.

B. Remove paint, varnish and brush marks from glazing material and, upon completion of painting Work, wash and polish glazing material both sides. Glazing material, which is damaged, shall be removed and replaced with new material.

C. Clean hardware and other unpainted metal surfaces with recommended cleaner. Do not furnish abrasives or edged tools.

3.04 SCHEDULE

A. Interior:

1. Woodwork, Painted: 3 coats.

a. First Coat: As specified in this section under Priming.

b. Second and Third Coats: Interior enamel, semi-gloss or gloss as indicated.

2. Woodwork, Stained and Varnished: 4 coats.

a. First Coat: As specified in this section under Priming.

b. Second, Third and Fourth Coats: Varnish, semi-gloss.

3. Wood Corridor doors: 4 coats.

a. First Coat: As specified in this section under Priming.

b. Second, Third, and Fourth Coats: Varnish, gloss.

4. Other Wood Doors: 4 coats.

a. Varnished or painted as indicated.

b. If varnished, same finish system as painted woodwork, with semi-gloss or gloss finish to match adjacent wall.

5. Miscellaneous Woodwork: 4 coats. Wood items including, but not limited to stair treads and risers, handrails, rolling ladders, wood base and shoe, chair rails, counter tops and locker room benches.

a. First Coat: As specified in this section under Priming.

b. Second, Third and Fourth: Exterior varnish, gloss.

6. Casework: Interior surfaces of casework (except plastic laminate-faced casework) including top, edges and underside of shelving, poles, surfaces of drawers (except fronts), interior surfaces of mailbox pigeonholes, and particle board.

a. First Coat: Waterborne stain.

b. Second and Third Coats: Satin varnish.

7. Plaster: 4 coats.

a. First Coats: Pigmented wall sealer.

b. Second coat: Enamel under coater.

c. Third and Fourth Coats – Interior enamel, semi-gloss or gloss as indicated.

8. Gypsum Board: 4 coats.

a. First Coat: Drywall sealer.

b. Second Coat: Enamel under coater.

c. Third and Fourth Coats: Interior enamel, semi-gloss or gloss as indicated.

9. Concrete: 3 coats.

a. First: Concrete sealer.

b. Second and Third: Interior enamel, semi-gloss or gloss as indicated.

10. Concrete Block: 3 coats.

a. First: Concrete block filler.

b. Second and Third: Interior enamel, semi-gloss or gloss as indicated.

11. Metal: Shall be cleaned, pre-treated and painted with 3 coats. Items to be painted include, but are not limited to: exposed structural and miscellaneous steel, metal doors and frames, ladders, table and bench legs.

a. First Coat: Metal primer.

b. Second and Third Coats: Interior gloss enamel, except metal doors and frames which shall be semi-gloss or gloss to match adjacent wall.

B. Exterior:

1. Woodwork: 3 coats.

a. First Coat: As specified in this section under Priming.

b. Second and Third Coats: Exterior house and trim enamel.

2. Wood Doors: 3 coats.

a. First Coat: As specified in this section under Priming.

b. Second and Third Coats: Exterior gloss enamel.

3. Plaster and Stucco: 3 coats. Flat 100 percent acrylic.

a. Prime Coat: Alkali resistant primer/sealer.

b. Exterior 100 percent acrylic.

4. Concrete: 3 coats. Flat 100 percent acrylic.

a. First Coat: Concrete sealer.

b. Second and Third Coats: Exterior 100 percent acrylic.

5. Concrete Block: 3 coats. Flat 100 percent acrylic.

a. First Coat: Concrete block filler.

b. Second and Third Coats: Exterior 100 percent acrylic.

6. Metal: 3 coats. Shall be cleaned and pre-treated. Items to be painted include, but are not limited to: steel columns and miscellaneous steel items, gravel stops, metal doors and frames, hoods and flashings.

a. First Coat: As specified in this section under Priming.

b. Second and Third Coats: Exterior gloss enamel.

C. Mechanical and Electrical Work:

1. Except where interior mechanical and electrical Work to be painted is specified to receive another paint finish, Work occurring in finished rooms and spaces shall be cleaned, pre-treated, and painted with 3 coats. Items to be painted include, but are not limited to: steel and copper piping, pipes, vents, fittings, ducts, plenums, miscellaneous supports and hangers, electrical conduit, fittings, pull boxes, outlet boxes, unfinished surfaces of plumbing fixtures, miscellaneous metal cabinets, panels, and access doors and panels.

a. First Coat: As specified in this section under Priming.

b. Second and Third Coats: Interior enamel, semi-gloss or gloss to match adjacent wall or ceiling finish.

2. Insulation and Taping on Pipes and Ducts: 3 coats.

a. Finished Rooms:

1) First Coat: Interior waterborne primer.

2) Second and Third Coats: Interior semi-gloss or gloss enamel to match adjoining wall or ceiling finish.

b. Building Exterior:

1) First Coat: Exterior waterborne primer.

2) Second and Third Coats: Exterior gloss enamel.

3. Inside surfaces of ducts, vents, dampers and louvers as far back as visible from room in which they open shall be painted with 2 coats of flat black paint.

D. Miscellaneous:

1. Outside Storage Units (wood or metal): 3 coats.

a. First Coat: As specified in this section under Priming.

b. Second and Third Coats: Exterior gloss enamel.

2. Exterior and interior surfaces of storage bins, and potting tables shall have 3 coats of acrylic stain.

3. Wood compost bins shall be finished with 3 coats of acrylic stain.

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.06 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 11 4019

FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Food Service Equipment.
2. Air screens.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Division 22 – Plumbing.
3. Division 23 – Mechanical.
4. Division 26 - Electrical.

1.02 SYSTEM DESCRIPTION

A. Design Requirements:

1. Provide adequate air supply and exhaust for self-contained refrigeration condensing units.
2. Install food service equipment, complete and in strict accordance with Construction Documents.
3. Equipment shall be of a nature and so installed as to be readily cleanable or made easily removable for cleaning.
4. Furnish accessories and parts necessary to complete installation.
5. Coordinate work of this section with delivery and installation.
6. Anchor bolts, sleeves and other items required to be built into masonry and concrete shall be furnished promptly so they may be built in as work progresses.
7. Furnish embedded restraining devices, and fittings as required to secure equipment and fixtures, whether new or reinstalled.
8. Work shall be designed and fabricated to suit field conditions and fitted with proper joints and intersections.

B. Regulatory Requirements:

1. Whichever drawings, specifications or regulations require larger sizes or higher standards, the more stringent shall govern.

2. Work and materials shall be in accordance with current editions of the following:
    a. U.S. Public Health Service.
    b. National Fire Protection Association.
    c. Current National Sanitation Foundation standards.
        1) All custom fabricated items and equipment shall conform to current standards and revisions established by National Sanitation Foundation.
    d. Equipment must comply with applicable safety and sanitary standards of any recognized testing agency certified by American National Standards Institute (ANSI).
    e. Local or state ordinances regarding the use of steam.
    f. Los Angeles County Department of Public Health.
    g. State Accident Commission's Safety Orders.
    h. Cal OSHA.
    i. Current Edition of CBC.
    j. California Fire Code.
    k. Environmental Protection Agency regulations.
    l. State and local guidelines and regulations for seismic restraint of food service equipment and fixtures.
    m. National Sanitation Foundation.
    n. National Electrical Manufacturers Association.
    o. Underwriters' Laboratories, Inc.

C. Fees: Installer shall obtain and pay for the following:
    1. Required permits and certificates of acceptance or of completion.
    2. Inspection certificates and licenses required and necessary for performance of Work.Post notices as required by code.
    3. Deliver certificates to OAR. OAR will withhold payment until necessary certificates are delivered.

1.03 SUBMITTALS

A. Request for substitution must be made in accordance with Division 01 of Project Manual.

B. Provide mounting templates for equipment and fixtures requiring fasteners set into masonry or concrete.

C. Rough-in Drawings: Prepare and submit separate electrical and mechanical dimensioned rough-in drawings at 1/4"=1'-0" showing penetrations for services required, including refrigerant and beverage piping. Indicate locations and size of bases, openings in walls for equipment or operations, and critical dimensions.

D. Shop drawings: Prepare and submit shop drawings for custom fabricated equipment or fixtures and refrigeration systems. Include the following information.

1. Include large scale details of custom fabricated equipment.
2. Sizes and locations of mechanical and electrical services.
3. Curbs or other bases for custom fabricated items.
4. Indicate sizes and location of anchor sleeves and other items required to be built into work.
5. Include sizes and locations of mechanical and electrical services for OWNER furnished equipment to be relocated under this contract.
6. Deviations from Construction Documents will only be allowed if approved in writing.
7. Refrigeration System drawings shall be labeled "R-1", etc., showing systems schedules, notes, specifications, system multiplexing scheme, and other data.
8. Furnish six sets of submittal drawings.

E. Product Data and Specifications Sheets: Furnish six sets of submitted equipment bound in binder and indexed. Each fixture shall is identified with an item number, accessories and finishes.

1.04 QUALITY ASSURANCE

A. Inconsistencies between drawings and notes or code shall be resolved before commencing work.

B. Field verify conditions at site before proceeding with work.

C. Follow manufacturer's directions where installation is not indicated on drawings or specifications.

D. Dimensions indicated on drawings have been secured from best available information. Field verify dimensions.

E. Allow space for fittings.

F. Installer shall make final connections.

G. Submit certification from refrigerator-freezer manufacturer stating that the installers for this project are certified by them for this type of installation.

1.05 EQUIPMENT LIST APPROVAL

A. In order to establish a standard of quality, equipment listed is specified from the indicated manufacturer.

B. OWNER’s Food Services Branch will establish equivalency and compliance of product or components offered for installation under this Contract.

C. When drawings are submitted for installation, their approval shall not waive requirements indicated in construction documents.

1.06 OPERATING INSTRUCTIONS AND MANUALS

A. Furnish three copies of bound "Operating Instructions and Service Manual" to OAR upon substantial completion of work. Incorporate complete information, including but not limited to following:

1. Part numbers of replaceable items.
2. Manufacturer's cuts and rating tables.
3. Oiling, lubrication and greasing data.
4. Belt sizes, types and lengths.
5. Serial numbers of principal pieces of equipment.
6. Installing and service representatives companies, names, addresses, and phone, e-mail and FAX numbers.

1.07 PRODUCT HANDLING

A. Deliver equipment to project site new condition, free from defects or damage. Rejected items shall be removed from project and replaced without additional cost to OWNER.

B. If equipment is too large to be moved through permanent openings in building, Installer shall make arrangements to have suitable temporary openings provided at his expense, or he shall furnish his equipment in sub-assemblies which may be moved through permanent openings and then assembled.

C. Installer shall make provision and pay storage fees for items delivered to job site before and during installation. If receipt and storage cannot be arranged, items must be received and accounted for by Installer.

1.08 COORDINATION

A. Verify size and position of duct work and connections for hoods before fabrication.

B. Where flatware dispensers are specified, verify dimensions and weight before placing orders with manufacturers.

C. Lengths between walls for custom fabricated fixtures, and also ceiling heights, shall be field verified.

D. Verify location of remotely located mechanical refrigeration compressor racks, and length of refrigerant line runs.

1.09 SERVICE

A. Food service equipment and fixtures shall be supported by a service organization reasonably convenient to site that will assure service will be performed within twenty-four hours of service request.

B. Manufacturer, or his agent, shall maintain an adequate stock of repair parts which shall be available for immediate, local delivery.

1.10 WARRANTY

A. Unless otherwise specified under item number, warranty shall be manufacturer’s standard.

B. Self-Contained Refrigeration Equipment:

1. One year, after date of substantial completion, service and maintenance contract for parts and installation.

2. Five years warranty on parts, except when otherwise specified.

PART 2 - PRODUCTS

2.01 FOOD SERVICE EQUIPMENT LIST

A. Refer to the Drawings.

B. Provide manufacturer's standard specification sheets for commercially manufactured equipment listed.

C. Provide all standard accessories unless specified, and provide options called out.

2.02 MATERIALS GENERAL

A. Electrically Heated Equipment:

1. Electrically heated or thermostat controlled equipment shall be furnished complete. Material, size, or rating shall be as specified herein, or as indicated on the drawings.

2. Electrical appliance or heating elements connected to 120 volts circuits shall not exceed 1650 watts, except as otherwise noted in the specifications or drawings.

B. Switches, Controls and Electrical Work:

1. Each motor driven appliance or electrically heated unit shall be provided with a suitable control switch or starter in accordance with U.L. requirements.
2. All other fittings, and connections shall be furnished and installed in compliance with Division 26.
3. Provide internally wired equipment with a junction box, push button switches, starters, and other apparatus, built into or forming an integral part of these items. Provide materials and labor for a complete electrical installation in compliance with applicable codes and industry standards.
4. Walk-in refrigerators and freezers shall be equipped with door operated switches with pilot lights.
5. Provide standard three-prong plugs to fit "U" slot grounding type receptacles for equipment items powered by 110-120 volts, single phase current with suitable length three-wire power cord.

C. Convenience Outlets: Provide custom fabricated fixtures with properly sized cut-outs for power receptacles. Electrical boxes shall be mounted at locations indicated on the drawings.

D. Electric Motors and Starters:

1. Adjust or replace equipment producing objectionable noise.
2. Motors larger than 1/4 horsepower, but less than ½ horsepower:
   a. Motors smaller than 1/2 horsepower shall be 120 volts, 60 cycles, single phase.
   b. Equip motor starter with overload protection.
   c. Provide starters and deliver to job site for installation under Electrical Section, if they are not a standard part of the equipment.
   d. Automatic starters shall be General Electric #CCF7006, or equal. Push button station shall be included.
3. Motors 1/2 horsepower and larger:
   a. Unless otherwise indicated, 1/2 horsepower or larger motors shall be 208 volts, 60 cycles, 3-phase, or 480 volts, 60 cycles, 3-phase.
   b. Motors not having automatic operation starters shall be supplied with General Electric CR062 starters, or equal.
4. Motors under 1/2 horsepower and not having automatic operation shall be provided with a General Electric #CR1061 starters or equal.
   a. Starter shall be enclosed and surface mounted type.

b. 120 volt motors shall have single pole starters.

c. 208 and 480 volts, 3-phase motors shall have 3-pole starters.

E. Connection Terminals: equipment shall be furnished complete with standard connection terminals.

F. Thermometers: refrigerated equipment shall be fitted with digital read out thermometers, or dial type thermometers with chrome plated bezels, as required by NSF.

1. Thermometers shall be adjustable and shall be calibrated after installation.

G. Trim and Seal:

1. Space between units to walls, ceilings, floors, and adjoining units not portable and with enclosed bodies shall be completely sealed against entrance of food particles and vermin by means of trim strips, welding, soldering, or commercial joint material as suited to equipment.

2. 2Ends of hollow sections shall be closed.

3. Enclosed fixtures without legs and not mounted on bases shall be sealed water-tight to floor, except when specified to be portable.

4. Provide floor type drip pans and expansion joint material for sealing pan edges to finish floor.

a. Joint sealing materials shall be two-part sealing compound “Weatherban” as manufactured by 3M.

b. Color shall match floor grout.

c. Install sealer according to manufacturer's instructions.

H. Locks: Provide doors of refrigerated compartments with cylinder locking type latches, keyed and master keyed to building standards.

2.03 AIR CURTAIN

A. Mars Air Doors, or equal. Model NCH, NSF approved series, of widths indicated in the drawings. Provide motor control panel and door micro switch. Air screen shall be hardwired to power supply. Micro switch shall activate air screen when door opens.

2.04 CUSTOM STAINLESS STEEL FABRICATIONS

A. General: custom fabricated stainless steel equipment shall be manufactured by one company. equipment shall have same general style and appearance.

B. Materials:

1. Stainless Steel: U.S. standard type 304, 18-8, not over 0.013 percent maximum carbon. Exposed surfaces shall be polished to #4 finish.

2. Sound Deadening Material: NSF approved, such as #Q75-1366 as manufactured by Component Hardware Group Inc., or equal.

C. Legs and Cross-bracing: Legs and cross bracing shall be stainless steel. Cross-bracing shall be 1 5/16-inch outside diameter, legs 1 5/8-inch. Welds shall be ground smooth. Legs shall be fitted with a stainless steel "bullet type" foot. Foot shall have a minimum 3/4 inch height adjustment. Legs shall be fastened to equipment as follows:

1. To sinks by means of enclosed gussets welded in place. Gussets shall be completely enclosed sanitary stainless steel, reinforced with bushings, and have set screws for securing legs.

2. To metal tops and dish tables with enclosed gussets (as above) which shall be welded to a closed stainless steel hat channel section 14 gage, minimum. Bracing shall be welded to underside of top.

3. Gussets shall be stainless steel enclosed type having a minimum 3-inch diameter at top. Top shall be continuously welded to frame members or sink bottom.

D. Sinks:

1. Sink compartments and tops: shall be 16 gage polished stainless steel, installed in tops as an integral part of fixture. Compartments shall be fully coved at vertical and horizontal interior corners. Where one or more sink compartments are adjacent, partition shall be double thickness continuously welded where sheets join at top. Multiple compartment sinks shall be creased to insure complete drainage to waste opening.

2. Exposed Sink Bowls: Exterior shall be polished to a #4 finish. Underside of sinks shall be sound deadened.

3. Provide custom fabricated sinks with twist handle waste outlets. Valves shall be chrome plated, 2-inch size with 1 ½-inch threaded adapter with tail piece.

4. Die drawn insert type sinks shall have 3 ½-inch basket type waste outlets.

5. Faucets: Refer to Section 22 1000 - Plumbing.

6. Sinks:

a. Three Compartment Sink: Welded 14 gauge type 304 stainless steel, with cross-bracing and adjustable feet. Three 24-inch long by 26-inch wide by 15-inch deep sinks, 24-inch drain boards at each end and 16 gauge stainless steel shelves under each drain

board. Provide 10-inch high back splash. See plans and elevation drawings for details and dimensions.

b. Preparation Sink: welded 14 gage type 304 stainless steel, with cross-bracing and adjustable feet. Two 18-inch by 24-inch by 14- inch deep sinks, with drain boards on both ends and 16 gage stainless steel shelf under drain board. Provide 8 inch high back splash. Splash mounted faucet, , coordinate with section 22 1000 Plumbing.

c. Hand Washing Sink: Advance Tabco model 7-PS-25. Physically Challenged Hand Sink, wall model, 14" wide x 16" front-to-back x 5" deep bowl, 18 gauge 304 series stainless steel, deck mounted faucet with wrist handles, deck mounted soap dispenser (pump), basket drain, wall brackets, NSF. Provide with welded stainless steel side splashes and wall-mounted towel dispenser.

E. Service Counter: One-piece, stainless steel, 14 gage top, with 10-inch high backsplash. Reinforce under-side with closed stainless steel hat sections welded into place (so tops can support heavy weights without deflection). Cross bracing shall not be more than 30-inch on center. Apply sound deadening material to underside of top after reinforcement sections have been fastened.

1. Assembly: seams and joints shall be shop welded or soldered; materials 18 gage or heavier shall be welded. Welds shall be ground smooth and polished to match original finish. Field joints in tops, where required shall be made sanitary, tight, leak-proof, and without open seams. Join seams by welding or with properly designed draw fastening trim strips, unless otherwise indicated. Butt joints made by riveting straps and filling with solder will not be accepted. Lead solders shall not be used where surface may come into contact with food.

2. Provide 14 gage stainless steel continuous under shelf.

F. Stainless Steel Work Table, Mobile: 48 inch long by 30 inch wide by 34 inch high, 14 gage top, type 304, # 4 finish, stainless steel work tables on 4 casters, with 2 wheels locking. Die formed with welded corners and full length hat channels bracing. Feet shall be Stainless steel tubing with adjustable bullet feet. Provide 14 gage, stainless steel under-shelf and one 21 inch wide by 21 inch deep minimum by 6 inch high drawer at each table, mounted in a stainless steel enclosed frame housing. At least one unit shall be fabricated to comply with ADA requirements.

1. Drawers: Mount drawers on 14 gage interlocking channel supports. Suspension shall be large size quiet ball bearing wheel. Provide stops to prevent drawers from being pulled out of fixture. Slides shall be supported so that drawers may be pulled out a minimum of 2/3 its length and support heavy loads without deflection. Drawers shall remove easily

without use of tools and shall be self closing. drawers shall have a removable 20 gage stainless steel insert pan with coved corners. Fronts shall be stainless steel double-cased with recessed pulls.

2. Casters: Heavy duty, with ball bearing disc wheels and replaceable grease-proof rubber, neoprene or polyurethane tires. Wheels shall be 5-inch diameter, unless specified otherwise, with minimum tire tread width of 1 ½-inch, capacity 250 pounds. Provide pressure type grease fittings, tread guards, and polished plated finish.

G. Backsplashes, Edges and Ends fabricate as follows unless otherwise indicated:

1. Tops including their respective backsplashes and turned-up-edges, shall have bends a minimum of ½ inch radius.

2. Provide 2-inch return to wall: Top of return shall have a 30 degrees slope. Crimp top of return to accept vinyl plastic sealing gasket. If backsplash is tight against wall, seal with silicone sealant.

3. Marine edges: Unless otherwise indicated shall be 5/8 inch deep, provided 1 3/4-inch facing. Crimp facing with a 45 degrees angle. Rolled edges shall have 1 ¾-inch diameter corners. Bullnosed edges shall have 1 ¾-inch diameter corners.

4. Ends of fixtures, backsplashes, and shelves, shall be filled by forming metal or welded sections. Entire back of fixture shall be flush to walls or adjoining equipment.

H. Shelf and Utensil Rack: Fabricated assembly in length and configuration as indicated on the drawings and including the following:

1. Two 12-inch deep, 16 gage stainless steel shelves mounted on wall with 14 gage brackets.

2. ¼" by 2 inch stainless steel flat bar utensil rack, two tier with 14 gage stainless steel support brackets and stainless steel double sided pot hooks mounted on six inches on centers.

I. Pot Rack: Advance Tabco SW-84 12 inch deep by 7 foot long, ¼” by 2 inch stainless steel mount on wall. Provide 28 stainless steel S hooks.

J. Over Shelf: Two 16 gage stainless steel shelves, 14 inches wide. Length as indicated on drawings. Mount on wall with 14 gage brackets.

K. Stainless Steel Miscellaneous Fabrications:

1. Wall Flashing and Utility Chases: 20 gage stainless steel, of height as indicated on drawings, minimum length of flashing shall be 36 inches. Utility chases shall be provided with caps. Flashing shall be installed without exposed fasteners. Provide stainless steel tees and/or ells at each panel on both sides and at tops and bottoms.

2. Utility Pedestals: 14 gage stainless steel provided with caps, and without exposed fasteners. Provide stainless steel ells along exposed edges. Provide removable access panel on one side. Frame chase with 1-1/2" by 14 gage stainless steel angles. Provide with 14 gage NSF approved stainless steel coved base at floor.

3. Utility Chase: Fabricated assembly in length and configuration as shown on the drawings, provide with accessible panels, and shall include the following:

   a. 20 gauge stainless steel wall panels, minimum length to be 36", with one inch thick mineral wool blanket or ceramic fiber blanket and wire mesh backing spaced out one inch on non-combustible spacers per CMC Sec. 508.4.

   b. Wall lining shall be fluted vertically every six inches.

   c. Wall lining shall be installed without exposed screws and bolts.

   d. Provide stainless steel "tees" and/or "ells" at each panel on both sides, bottom and top.

   e. Provide 14 gauge stainless steel end caps full width of wall and at each side of wall.

   f. Wall lining shall meet the requirements of NFPA-96 and local codes and ordinances.

4. Corner Guards: 14 gage stainless steel; 60-inch high by 2 ½-inch by 2 ½-inch, or as indicated on drawings. Mount on top of finish floor coved base. Secure to walls with flat head stainless steel screws and water resistant adhesive.

5. Perimeter Trim Around Kitchen Hood and Walk-In Ceilings: 20 gage 3-inch by 2-inch angle, steel trim installed from walk-in refrigerator and freezer to wall in front on both sides and at top header. Install from top of coved floor base up to header on sides.

L. Fasteners: Exposed screw or bolt heads will not be permitted, including wall flashing. Rivets, if specified, shall be counter-sunk flush and of same material as pieces being joined.

PART 3 - INSTALLATION

3.01 GENERAL

A. Food service equipment shall be installed strictly in accordance with approved shop drawings and manufacturers' instructions.

B. Installation of cooking equipment shall comply with applicable codes, for each type, of equipment indicated. Compliance with installation requirements shall be sole responsibility of Installer.

C. Install equipment level, and securely fasten fixed equipment in place.

3.02 OPERATIONAL TESTS AND INSPECTION

A. Request facility inspection by Environmental Health authorities and other jurisdictions responsible.

B. Prior to Substantial Completion, operate and test refrigerator and freezer equipment and systems for at least 14 consecutive days to demonstrate satisfactory overall operation as a completed unit.

1. Notify Project Inspector at least three days in advance of start of testing.

2. Tests shall commence after preliminary balancing and adjustments to equipment and systems to ensure proper operating condition.

3. Repair or replace defective work.

3.03 SEISMIC RESTRAINTS FOR EQUIPMENT AND FIXTURES

A. Fixed equipment and fixtures shall be anchored and secured to structural members according to requirements current CBC.

3.04 FINAL CLEANING

A. Clean, sanitize and have ready for operation food service equipment and fixtures at time of Environmental Health inspections and at time of turn over of facility to OWNER.

3.05 CLEAN UP

A. Remove debris and rubbish from premises and legally disposed of.

B. Equipment shall be clean and ready for use when turned over to Owner.

1. Protection of completed and cleaned work shall be responsibility of Kitchen Equipment Supplier.

2. Include existing-reset equipment as listed in specifications.

3.06 ADJUSTMENT OF EQUIPMENT AND DEMONSTRATION

A. Equipment shall be tested for leaks, poor connections, inadequate or faulty performance. Adjust and correct, if necessary; proper operation.

1. Thermostatically controlled equipment and equipment with automatic features shall be operated for 14 days to prove controls are functioning as intended. Walk-in refrigerators and freezers shall be turned on and ran for a minimum of fourteen days.

B. At a time and date, as selected by Owner, Supplier shall demonstrate equipment for Owner. Demonstrations shall be conducted by factory trained engineers of various equipment manufacturers and shall be done in two stages: First

demonstration shall be for Operations Branch representative. Second for Maintenance personnel. A representative of Kitchen Equipment Supplier must be in attendance at both demonstrations.

C. Refrigeration equipment shall be run as a minimum of three days duration before acceptance.

END OF SECTION

SECTION 22 0500

COMMON WORK RESULTS FOR PLUMBING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. This Section provides the basic plumbing requirements that apply to the Work of Division 22.

B. Related Requirements:

1. Division 01: General Requirements.
2. Division 22: Plumbing
3. Division 23: HVAC
4. Division 26: Electrical.

1.02 REGULATORY REQUIREMENTS

A. Current federal Safe Drinking Water Act (SDWA) regulations require the furnishing of lead-free pipe, solder, and flux in the installation or repair of plumbing in non-residential facilities connected to public drinking water systems. Under this regulation, solders and flux are considered lead-free when they contain 0.2 percent lead or less. Under California regulations pipes and pipe fittings are considered lead-free when they contain 0.25 percent lead or less as defined in California Assembly Bill 1953 (AB 1953). No pipe, pipe fittings, or any other fitting or fixture intended to convey or dispense water for human consumption by drinking or cooking is allowed in the domestic plumbing system, if they do not meet the low lead definition of AB 1953. Weighted average lead content of the wetted surface area of pipes, fittings and fixtures may not exceed 0.25 percent.

1. Provide lead-free water pipe, solder, and flux materials that meet the standards as outlined by the federal SDWA regulations and California AB 1953 if installed in drinking water system.
2. Collect pipe, solder, and flux material samples as required by the Project Inspector. Test samples shall be delivered to an Owner designated testing laboratory for testing of lead content.
    a. Test samples for lead content by the atomic absorption spectrophotometry method.
3. Materials found not conforming to SDWA and California AB 1953 regulations shall be deemed defective Work and shall be replaced with lead-free materials.
4. Comprehensive testing of the remaining materials for their lead content shall be performed as required by the Project INSPECTOR.

A. Materials, fabrication, equipment, and installation shall comply with industry standards and code requirements. Where manufacturer's recommendations exceed

industry standards, the manufacturer's recommendation shall establish the minimum standard. As a minimum, standards from the following organizations shall apply:

1. ANSI - American National Standards Institute.
2. ASME - American Society of Mechanical Engineers.
    a. ASME Boiler and Pressure Vessel Code.
    b. ASME B31 - Standards for Pressure Piping.
3. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers.
4. ASTM - American Society for Testing and Materials.
    a. ASTM A53 Specification for Welded and Seamless Pipe.
5. AWWA - American Water Works Association.
6. CSA - Canadian Standards Association.
7. FM Global - Factory Mutual Global
8. IAPMO - International Association of Plumbing and Mechanical Officials.
9. NFPA - National Fire Protection Association.
10. OSHA - Occupational Safety and Health Administration.
11. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association.
12. UL - Underwriters Laboratories Inc.
13. Intertek (ETL Certification).

B. Materials, fabrication, equipment, and installation shall comply with federal, state, and local codes including, but not limited to, the following:

1. CBC, California Building Code, and CMC, California Plumbing Code.
    a. Latest edition as adopted by the County of Los Angeles, and the State of California including amendments effective on the Effective Date of the Contract.
2. California Code of Regulations, Title 8, Industrial Relations, Division 1, Chapter 4, Division of Industrial Safety.

3OSHA - Occupational Safety and Health Administration.

4. CDPH - California Department of Public Health.
5. SCAQMD - South Coast Air Quality Management District.

C. Specifications or Drawings shall not be construed to permit deviation from the requirements of governing codes unless approval has been obtained from legally constituted authorities having jurisdiction, and the Architect. The Contract Documents may contain more stringent requirements than those legally required.

D. Permits and Fees: Refer to the General and Supplementary Conditions.

1.03 SUBMITTALS

A. Provide submittals in accordance with Section 01 3300: Submittal Procedures and with specific requirements of Division 22 sections, as applicable.

B. The above information shall become the basis for inspecting and testing materials and actual installation procedures performed in the Work.

C. Shop Drawings: Submit one additional copy when control diagrams having line voltage connections are indicated. Shop Drawings shall be specifically prepared for the Work of this Project. Drawings prepared in accordance with requirements of Section 01 3113: Project Coordination and Section 01 3300 may be provided by the Architect to serve as a background for the Shop Drawings. Shop Drawings shall comply with the requirements of Section 01 3113 and Section 01 3300 and shall indicate at a minimum:

1. Complete system layout of equipment, components, plumbing fixtures, piping, indicating service clearances, and pipe sizes, fitting types and sizes and pipe elevations, distances of pipes and equipment from building reference points and hanger support locations. The above items shall be coordinated on the shop drawings according to the requirements of Section 01 3113.

2. Schedule and description of equipment, piping and fittings.

1.04 PROJECT RECORD DOCUMENTS

A. Comply with provisions of Section 01 7700: Contract Closeout.

B. Project Record Drawings:

1. Provide a complete set of plumbing and fire protection drawings in AutoCAD and, if available, BIM, complete with external reference drawings, fonts, blocks and plotter pen color/line thickness settings on an USB flash drive. Also submit one set of full size reproducible plots on vellum and 3 sets of prints.

2. Before Contract Completion, deliver corrected and completed prints to the OAR. Delivery of project record documents to the OAR does not relinquish responsibility of furnishing required information omitted from project record documents.

C. Operation and Maintenance Manuals:

1. Submit two copies of operation and maintenance manuals in required form and content. If no revisions are required, furnish one additional copy. If revisions are required, one copy shall be returned with instructions for changes; perform such changes and return three copies of manuals. Manuals shall be bound in accordance to Section 01 7700. Deliver manuals to the OAR. Submit an electronic copy of the entire manual in PDF file format.

2. Contents of Manual:

a. Title sheet with Project name, including names, addresses and telephone number of Contractor, installer, and related equipment suppliers.

b. Manufacturer's operating instructions including, but not limited to, the following:

1) Identification of components and controls.

2) Trouble shooting checklist and guidelines.

3) Recommendations for optimum performance.

4) Warnings and safety precautions on improper or hazardous operational procedures or conditions

c. Manufacturer's product data and parts and maintenance booklet for each item of equipment furnished under Division 22 that includes the following as a minimum:

1) Manufacturer’s model, identification and serial numbers.

2) Exploded view of assembly drawings identifying each component or part with the relevant part number.

3) Directory of manufacturer’s representatives, service contractors and part distributors.

4) Maintenance and trouble-shooting instructions, including schedule for preventive maintenance, periodic inspection and cleaning criteria.

d. Project Record Drawings: Complete set of plumbing, fire protection and control system drawings in 50 percent reduced print format shall be furnished with the manual. Submit the above record drawings on an USB flash drive in AutoCAD and, if available, BIM, complete with external reference drawings, fonts, blocks, and plotter pen color/line thickness settings.

e. Testing, Adjusting, and Balancing reports: Submit as specified in Section 23 0593.

f. South Coast Air Quality Management District (SCAQMD) permits to install and operate boilers, water heaters and other fuel burning equipment and third-party source test reports as required by SCAQMD to allow start-up and operation of equipment.

g. Los Angeles County industrial waste permits.

h. Valve directory complete with location, function, size, and model of each valve with reference to the project record drawings.

i. Equipment and component identification chart complete with location, function, size, and model of each equipment or component with reference to the project record drawings.

1.05 COORDINATION

A. Contract Documents indicate extent and general arrangement of Work under Division 22. Contractor shall coordinate work in accordance with Section 01 3113 requirements and make adjustments as required to provide maximum headroom, a neat arrangement to keep passageways and openings clear to provide accessibility and provisions for maintenance, and to meet code requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage: Deliver materials to Project site in their original unopened containers with labels intact and legible at time of delivery. Store in strict accordance with manufacturer's recommendations.

B. Do not store plastic pipe or materials in direct sunlight.

1.07 PRELIMINARY OPERATION

A. OAR may require any portion of plumbing Work to be operated before Substantial Completion. Such operation shall be in addition to regular tests, demonstrations and instructions required under the Contract Documents, and shall be performed as required.

B. Notify the INSPECTOR at least 24 hours in advance of lighting or re-lighting pilots.

1.08 TRAINING OF OWNER PERSONNEL

A. Training of Owner's personnel shall include:

1. A minimum of 4 hours of on-site overview of the overall Plumbing System.

2. Refer to Division 22 sections for specific training on each of the components of the Plumbing System.

B. Contract shall include the cost of training Owner operation and maintenance personnel in operating, adjusting, maintenance, trouble-shooting, and Project site repair of each component, equipment, or system provided under this Contract.

C. Operational and maintenance training shall be conducted on the Project site, unless indicated otherwise.

D. Upon completion of Owner training, a completion certificate indicating the nature of the training and a description of the systems, complete with equipment and component lists shall be issued to each trainee. The certificate should be issued in duplicate with one copy retained by OAR.

E. An attendance sheet with the names and signatures of all participants attending the training shall be submitted to the OAR and kept as part of the project documents.

1.09 GUARANTEES AND DAMAGE RESPONSIBILITY

A. Sound of water flowing in piping shall not be transmitted to building structure. Operation of mechanical system shall not produce operational sounds that can be heard outside of rooms enclosing apparatus or equipment.

PART 2 – PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Unless otherwise specified, materials and equipment shall be new, in good and clean condition. Equipment, materials, and components shall be of the make; type and model number noted on Drawings or specified. Pieces of equipment of the same type shall be by the same manufacturer.

B. Whenever an item is listed by a single proprietary name, with or without model number and type, it shall be for purpose of design only, to indicate characteristics and quality

desired. Proprietary designation listed on Drawings, or listed first in Specifications, is used as a basis for design to establish a standard for quality and performance and space requirements.

C. Equipment and materials indicated or required to be installed outdoors shall be of the type that is designed, manufactured, listed or approved by authorities having jurisdiction for outdoor installation by being resistant to the adverse effects of weather. The additional protective measures against outdoor weather required by the manufacturers' installation instructions and prevalent practice shall be provided.

D. For substitution of materials or products, refer to the General Conditions.

PART 3 – EXECUTION

3.01 SERVICE INTERRUPTIONS, OFF-SITE, GAS AND WATER

A. Schedule Work so there shall be no service interruptions of existing systems or systems during normal hours of operation of affected systems and facilities.

B. When service interruptions are mandatory, arrange in advance with the OAR as to time and date of such interruptions.

C. Systems, which are interrupted, shall be returned back into operation in such manner that they will function as originally intended.

3.02 CUTTING, NOTCHING, AND BACKING

A. Conform to California Building Code, Title 24, Part 2, for notches and bored holes in wood and for pipes and sleeves embedded in concrete and for cuts in steel, as detailed on structural Drawings.

B. Where pipes pass through, or are located within one inch of any construction element, install a resilient pad, ½ inch thick minimum, to prevent contact.

C. Furnish provisions for recesses, chases, and accesses and provide blocking and backing for proper reception and installation of plumbing Work.

3.03 LOCATION OF PIPING AND EQUIPMENT

A. Location of piping, apparatus and equipment indicated on the Drawings is approximate and shall be altered to avoid obstructions, preserve headroom, and provide free and clear openings and passageways.

B. Trenches parallel to footings shall not be closer than 18 inches to the face of footings and shall not be below a plane having a downward slope of 2 horizontal to one vertical, from a line 9 inches above bottom of footing.

C. Pipe in tunnels shall be installed close to one side of tunnel to provide maximum space for passage. Pipe shall not be installed through crawl hole unless otherwise specified or detailed on Drawings.

D. Place equipment in locations and spaces indicated, disassemble and/or reassemble equipment as required by Project conditions.

3.04 TESTS AND TESTING

A. Tests shall be as required under the applicable sections of Division 22, including this Section.

B. Additional tests may be required in the case of products, materials, and equipment if:

1. Submitted items are altered, changed, or cannot be determined as exactly conforming to the Contract Documents.

2. Performance testing and results may also be required on certain items which are as specified, including fan, and pump performance.

C. Piping Tests:

1. Perform tests required to demonstrate that operation of plumbing systems and their parts are in accordance with Specifications covering each item or system, and furnish materials, instruments and equipment necessary to conduct such tests. Tests shall be performed in presence of the Inspector, and representatives of any governmental agency having jurisdiction. Work shall not be concealed or covered until required results are provided.

2. If required tests are not performed, Owner may provide in accordance with the Contract Documents.

3. Pressure gauges furnished in testing shall comply with CPC. Air shall be bled from lines requiring hydrostatic or water tests.

4. Systems shall be pressure-tested in accordance with pipe testing schedule below. Pipe test shall indicate no loss in pressure after a minimum duration of 4 hours at test pressures indicated. Where local codes require higher test pressures than specified herein for fire sprinkler systems, local codes shall govern.

5. Fuel gas lines shall be first tested with piping exposed, before backfilling trenches or lathing; second with piping in finished arrangement, backfilled and paved where required, and walls finished.

6. Piping systems may be tested as a unit or in sections, but entire system shall successfully meet requirements specified herein, before final testing by the Inspector.

7. Repair of damage to pipes and their appurtenances or to any other structures resulting from or caused by these tests, shall be provided.

D. Pipe Testing Schedule:

System Tested	Test Pressure (psig)	Test With:
Durham system, glass or plastic acid waste, vent and roof drain (except pipes running under a slab or underground)	Fill with water to top of highest vent; allow to stand two hours, or longer, as required by Inspector. Minimum head required for any joint shall be 10 feet in building.	Water
Cast-iron soil, waste and interior downspout, condensate drain from air conditioning equipment	10 feet of water, vertically	

Storm water disposal lines	Running water test	Water
Vacuum pump or condensate pump discharge and condensate return piping	150	Water
Domestic water piping	200	Water
Standpipes, wet or dry	300	Water
Fire sprinkler piping	200	Water
Gas piping(steel threaded or plastic)	60 (both tests)	Air
Gas piping (steel welded)	100 (both tests)	Air
Gas welding station	1-1/2 Working pressure 100 min.	Dry nitrogen
Compressed air piping	175	Air

E. Equipment Performance Assurance Tests:

1. Before operating any equipment or systems, a thorough check shall be performed to determine that systems have been flushed and cleaned as required and that equipment has been properly installed, aligned, lubricated, and serviced. Factory instructions shall be checked to verify installations have been completed and recommended lubricants have been installed in bearings, gearboxes, crankcases, and similar equipment. Particular care shall be furnished in lubricating bearings to avoid damage by over-lubrication and blowing out seals. Equipment shall also be checked for damage that may have occurred during shipment, after delivery, or during installation. Damaged equipment, products, and materials shall be replaced or repaired as required.
2. Upon completion of the above, adjust the system settings to within normal operating conditions to prevent the system from being damaged upon start-up.
3. Run-test the equipment after start-up for five consecutive days. Tests shall include operation of all equipment and systems for a period of not less than two 8 hour periods at 90 percent of the full specified capacities.
4. Equipment Start-up Reports: For each equipment or system on which start-up is performed, submit 8 copies of start-up report for review by the Architect.
    a. The start-up report shall include the manufacturer's standard start-up form completed and signed by the start-up technician.
5. Provide, maintain, and pay costs for equipment, instruments, and operating personnel as required for specified tests.
6. Provide electric energy and fuel required for tests.
7. Final adjustment to equipment or systems shall meet specified performance requirements.
8. Equipment, systems, or Work deemed defective during testing shall be replaced or corrected as required. Test until satisfactory results are provided.

F. Specific Coordinated Plan for Test and Balance:

1. Provide a narrative of the operational intent that clearly describes the function and sequence of operation of each component, equipment, or system installed. Instruct designated Owner personnel in the operation of the installed systems.

2. Prior to final test and balance, plumbing equipment and systems shall be operated and tested as indicated in Article 3.04.F above to demonstrate satisfactory overall operation of the installed systems.

3. Welding performed as part of this Division may be subject to radiographic inspections at random in accordance with requirements specified in Section 22 0513: Basic Plumbing Materials and Methods.

3.05 NOISE AND VIBRATION REDUCTION

A. Correct noise or vibration caused by plumbing systems. Provide all necessary adjustments to specified and installed equipment and accessories to reduce noise to the lowest possible level

B. Correct noise or vibration problems caused by failure to install work in accordance with Contract Documents. Include all labor and materials required as a result of such failure. Pay for re-testing of corrected noise or vibration problems by the project acoustical consultant including travel, lodging, test equipment expenses, etc.

3.06 PROTECTION, CARE AND CLEANING

A. In addition to storage criteria of the General Conditions, and provisions under Section 01 5000: Construction Facilities and Temporary Controls, the following shall be provided:

1. Provide for the safety and good condition of materials and equipment until Substantial Completion. Protect materials and equipment from damage.

2. Protect installed Work.

3. Replacements: In case of damage, immediately provide repairs and/or replacements as required.

4. Protect covering for bearings, open connections to tanks, pumps, compressors and similar equipment.

5. Interior of piping shall be maintained free of dirt, grit, dust, and other foreign materials.

6. Fixtures, piping, finished brass or bronze, and equipment shall have grease, adhesive, labels, and foreign materials removed. Chromium, nickel plate, polished bronze or brass Work shall be polished. Glass shall be cleaned inside and out.

7. Before initial start-up and again before Substantial Completion, piping shall be drained and flushed to completely remove grease and foreign matter. Pressure regulating assemblies, traps, strainers, boilers, flush valves, and similar items shall be thoroughly cleaned. Tag system with an information tag listing responsible party and date of element, before initial start-up and again before Substantial Completion. Compressed air, oil, and gas piping shall be blown out with oil-free compressed air or inert gas.

END OF SECTION

SECTION 22 0513

BASIC PLUMBING MATERIALS AND METHODS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. This Section prescribes basic materials and methods generally common to the Work of Division 22.

B. Related Requirements:

1. Division 01: General Requirements.

2. Division 22: Plumbing.

3. Division 23: HVAC.

4. Division 26: Electrical.

5. Section 32 8413: Potable Water Irrigation.

1.02 SUBMITTALS

A. Provide in accordance with Division 01, Section 22 0500 and specific requirements of each section of Division 22.

B. Types of welding rods to be used.

1.03 QUALITY ASSURANCE

A. Standards: Comply with applicable national, state, and local codes and standards: ASTM, ASME, and ANSI. Federal Specifications, AWWA, SISPI, NFPA, FM, UL, CPC (California Plumbing Code), CMC (California Plumbing Code), CSA.

B. Conform to provisions of Section 22 0500: Common Work Results for Plumbing.

C. Manufacturer of plumbing products must be third-party certified to ANSI/NSF Standard 61, Section 9 certification, and ANSI/NSF 372 to demonstrate compliance with the federal requirements for lead contribution to drinking water, the Safe Drinking Water Act SDWA, and the California Health and Safety Code Section 116875.

D. Qualifications of Manufacturer: Products used in the Work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production as reviewed by the ARCHITECT.

1.04 COORDINATION

A. Coordinate related Work in accordance with provisions of Section 01 3113: Project Coordination.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide the following products if they are indicated in the Contract Documents or if they are required for the proper installation, function or operation of equipment, systems or components indicated in the Contract Document.

B. Provide the following products as a complete assembly with required accessories for a complete and functioning entity in compliance with governing codes and applicable standards as specified in Section 22 0500, manufacturer's instructions or as required.

1. Omission of minor details in the Contract Documents does not waive and/or otherwise relinquish compliance with the above requirements.

2.02 MANUFACTURERS AND MATERIALS

A. Ball Valves: 2-inch and smaller:

BV-1: Class 150, 600 psi, Bronze, CWP two piece construction with reinforced TFE seats, full port, adjustable packing gland, (no threaded stem designs allowed), threaded or solder ends.

Manufacturer: NIBCO T-685-66-LF/S-685-66-LF, Hammond UP8303A/UP8513, Milwaukee UPBA400S/ UPBA450S, or equal.

BV-2: Class 150, 600 psi, Stainless Steel, CWP two piece construction with reinforced TFE seats, full port, adjustable packing gland, (no threaded stem designs allowed), threaded or solder ends.

Manufacturer: NIBCO T-585-S6-R-66-LL, Milwaukee BA260, or equal.

Ball Valves in Insulated Piping: Use extended operating handle of non-thermal conducive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied. NIBCO Nib-Seal Handle.

B. Check Valves:

1. Bronze, 2-inch and smaller:

CHV-1: 200 psi, CWP horizontal swing, Y pattern, renewable seat and disc, threaded ends.

Manufacturer: NIBCO T-413-Y-LF, Milwaukee UP-509, Hammond UP-904, or equal.

CHV-2: 200 psi, CWP, bronze body, horizontal swing, Y pattern, renewable seat and disc, solder ends.

Manufacturer: Nibco S-413-Y-LF, Hammond Up-943, or equal.

CHV-3: Class 125, 200 psi, swing check, bronze body, Teflon disc, soldered ends.

Manufacturer: Stockham B-310TY, Crane 1340, NIBCO S-413-Y, Milwaukee 1509-T, Hammond IB-912, or equal.

C. Piping and fittings:

1. Piping shall be continuously and permanently marked with manufacturer's name, type of material, size, pressure rating, and the applicable ASTM, ANSI, UL, or NSF listing. On plastic pipe, date of extrusion must also be marked.

2. Underground non-ferrous pressure pipes shall be installed with proper color tracer wires. Refer to color code provisions in Section 22 0553: Plumbing Identification.

P-1: Cast iron: Hubless, service weight, ASTM A888, CISPI 301, conforming to CISPI 310 and installed in accordance to IAPMO IS 6.

Manufacturer: American Foundry, Tyler, AB & I, or equal.

PF-1a: Cast iron, soil or waste no-hub coupling with neoprene gaskets, stainless steel corrugated shields and stainless steel clamps. 2 bands for size 1 ½-inch thru 4-inch, IAPMO, ASTM C 564 and CISPI 310.

Manufacturer: American Foundry, Tyler, AB & I, or equal.

PF-1b: Cast iron, soil or waste, Heavy-duty no-hub coupling with neoprene gaskets, stainless steel corrugated shields and stainless steel clamps. 4 bands for size 5-inch thru 10-inch. IAPMO, ASTM C564 and CISPI 310.

Manufacturer: American Foundry, Tyler, AB & I, or equal.

P-2: Galvanized steel, Schedule 40, ASTM A53.

Manufacturer: US Steel or equal.

PF-2: Malleable iron, Class 150, threaded, galvanized, beaded, ANSI B 16.3.

Manufacturer: Stockham, Stanley Flagg, Grinnell, or equal.

P-3: Copper drainage tube, inside structure and above grade. Type DWV hard temper, ASTM B 306.

Manufacturer: Mueller, Anaconda, Cerro Brass, Cambridge-Lee, Halstead, or equal.

PF-3: Cast brass drainage fittings ASA B 16.23, ASTM B 42.

Manufacturer: Mueller Brass, Nibco, Stanley Flagg, Lee Brass, or equal.

P-4: Copper water tube, Type L hard, ASTM B88. (For above ground use only.)

Manufacturer: Mueller, Cambridge-Lee, Halstead, or equal.

PF-4a: Copper Press-Connect pressure fittings, comply with ASME B16.51 "Copper Alloy Press-Connect Pressure Fittings", with Ethylene Propylene Diene Monomer, EPDM O-Ring Seal in each end. Fittings with the sizes of 2-1/2" and larger shall have cross-section Grab Rings and separation rings.

Manufacturer: Viega, Mueller Industries, Apollo, or equal.

PF-4b: Wrought copper - solder type ANSI B 16.22.

Manufacturer: Mueller Brass, Nibco, Lee Brass, or equal.

PF-4c: Grooved end type– ASTM B75 or B152 and ANSI B16.22 wrought copper, bronze sand casting per ASTM B584-87 copper alloy CDA 836 per ANSIbB16.18. Couplings shall be CTS style 606 supplied with angle pattern bolt pads for rigidity, coated with copper coated alkyd enamel. Gaskets shall be pre-lubricated Flush seal type.

Manufacturer: Victaulic, or equal.

P-5: Copper water tube, Type K hard, ASTM B88.

Manufacturer: Mueller, Cerro Brass, Cambridge-Lee, Halstead, or equal.

P-7: Black steel pipe, Schedule 40, ASTM A53, Type E, ERW.

Manufacturer: US Steel, or equal.

PF-7a: Malleable iron, Class 125, ANSI B 16.3, threaded or welded Schedule 40 black steel for 2-inches and below and welded for 2 ½-inch and above.

Manufacturer: Stockham, or equal.

PF-7b: Grooved end type– ASTM A395 and A536 ductile iron; ASTM A234 WPB forged steel; fabricated from ASTM A53 carbon steel. Couplings shall be supplied with angle-pattern bolt pads for rigidity, except in locations where flexibility is desired. Gaskets shall be pre- lubricated.

Manufacturer: Victaulic, Galvanized or painted, or equal.

PF-7c: MegaPressG, ASME B31, Carbon Steel, – For aboveground piping 2-inches and below. Provide fittings with Hydrogenated Nitrile Butadiene Rubber, HNBR Sealing Element.

Manufacturer: Viega, or equal.

PF-7d: Malleable Iron, class 125, ANSI B 16.3, threaded schedule 80 black steel.

Manufacturer: Stockham, or equal.

P-8: Red seamless brass 85-5-5-5, iron pipe size (IPS), threaded pipe, ASTM B43.

Manufacturer: Mueller, Cerro Brass, Cambridge-Lee, Halstead, or equal.

PF-8: Bronze and brass, 250 psi, threaded, ASA B16.17 and F S WW-P-460.

Manufacturer: Mueller Brass, Lee Brass, or equal.

D. Pipe and Fitting Requirements Schedule: Unless otherwise specified or indicated on Drawings, pipe and fittings shall be installed in accordance with the following table:

TABLE I
PIPE AND FITTING SCHEDULE

Use	Limits	Pipe	Fittings
Condensate drains and drains From HVAC Equipment	All sizes	P-4, or P-6 *Roof penetration & above, and exterior exposed piping shall be P-6 only	PF-4b, or PF-6b *Roof penetration & above, and exterior exposed piping shall be P-6 only
Domestic Cold Water, underground	Within 5’ from building, All sizes	P-5	PF-4a, or PF-4b
Domestic Cold Water, underground	Site distribution only, 4” and over	P-9; Refer to 33 1100	PF-9; Refer to 33 1100
Domestic Hot and Cold water, aboveground	Interior only	P-4	PF-4a, or PF-4b
Natural Gas, Interior, aboveground	All sizes	P-7	PF-7a, PF-7b, or PF-7c

E. Pipe Isolators:

PLA-1 Absorption pad shall be not less than ½ inch thick, unloaded. Pad shall completely encompass pipe.

Manufacturer: Holdrite, LSP, Stoneman, Potter-Roemer, Trisolator, PR-Isolator, or equal.

Manufacturer: Hydra-Zorb Cushion Clamps, Acousto-Clamp, or equal.

F. Vent Caps:

VC-1 Vandal-proof hood type, for plumbing vent lines.

Manufacturer: Stoneman Engineering and Mfg., Semco 1550, or equal.

G. Vacuum Valves:

VV-1 Vacuum valves; for vacuum serve, 125 psig working pressure, cast iron body, spring loaded lubricated plug type.

Manufacturer: General Controls, Honeywell, Valmatic, or equal.

H. Flanges: Flanges shall be furnished and installed at each flanged connection of each type of equipment, tanks, and valves. Faces of flanges being connected shall be furnished alike. Connection of a raised face flange to a flat-faced flange is not permitted. Flanges shall conform to following schedules:

TYPE OF PIPE	FLANGE
Screwed black or galvanized grooved steel pipelines.	125-pound black cast iron screwed flange, flat faced or grooved flange adapters, Victaulic Style 741, Tyco-Grinnell Fig. 71, Gruvlok Fig. 7401, or equal.
Welded or grooved steel pipe, except high pressure steam lines.	150-pound black forged steel welding flanges, 1/16 inch raised face ASTM A 105, Grade II or grooved flange adapters, Victaulic Style 741, Tyco-Grinnell Fig. 71, Gruvlok Fig. 7401, or equal.
Copper and brass pipe or tubing.	150 pound cast bronze, flat-faced flange with solder end or grooved flange adapters, Victaulic Style 641, Tyco-Grinnell Fig. 61, Gruvlok Fig. 6084, or equal.

1. Gasket material for flanged connections shall be full faced or ring type to suit facing on flanges and shall be furnished in accordance with following schedule:

SERVICE	TYPE
Cold water	1/16-inch-thick neoprene

Grooved end flange adapters supplied with pressure responsive elastomeric Gaskets supplied with grooved flange adapters shall be pre-lubricated by the manufacturer. Grade of gasket to suit intended service.

I. Unions:

1. Unions shall be furnished and installed in accordance with the following requirements (unless flanges are furnished):

a. At each threaded or soldered connection to equipment and tanks, except in Freon or fuel gas, piping systems, whether indicated or not.

b. Immediately downstream of any threaded connection to each manually operated threaded valve or cock, and each threaded check valve, yard box or access box except those in Freon piping systems, whether indicated or not.

c. At each threaded connection to threaded automatic valves (except those in Freon piping systems) such as reducing valves and temperature control valves, whether indicated or not.

d. If grooved piping is used, couplings shall serve as unions. Additional unions are not required.

2. Unions shall be located so that piping can be easily disconnected for removal of equipment, tank, or valve.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which Work of this Section shall be performed. Correct conditions detrimental to proper and timely completion of Work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Provide all materials and equipment for the Work. Furnish and install necessary apparatus, parts, materials, and accessories.

B. Pipe Installation:

1. Install piping parallel to wall and provide an orderly grouping of proper materials and execution.

2. Piping shall clear obstructions, preserve headroom, provide openings and passageways clear, whether indicated or not. Verify the Work of other Divisions to avoid interference.

3. If obstructions or the Work of other Divisions prevent installation of piping or equipment as indicated by the Drawings, perform minor deviations as required by the ARCHITECT.

4. Install piping after excavation or cutting has been performed. Piping shall not be permanently enclosed, furred in, or covered before required inspection and testing is performed.

5. Exposed polished or enameled connections from fixtures or equipment shall be installed with no resulting tool marks or threads at fittings. Residue or exposed pipe compound shall be removed from exterior of pipe.

6. Piping shall be concealed in chases, partitions, walls, and between floors, unless otherwise directed or specifically noted on Drawings. When penetrating wood studs, joists, and other wood members, provide such members with reinforcement steel straps of Continental Steel & Tube Co., ULINE, Independent Metal Strap, or equal.

7. Reduce fitting where any change in pipe size occurs. Bushings shall not be furnished unless specifically reviewed by the ARCHITECT, or indicated on Drawings.

8. Piping subject to expansion or contraction shall be anchored in a manner, which permits strains to be evenly distributed. Swing joints or expansion loops shall be installed. Seismic restraints shall be installed so as not to interfere with expansion and contraction of piping. Seismic loops required at all building separations.

9. Immediately after lines have been installed, openings shall be capped or plugged to prevent entrance of foreign materials. Caps shall be left in place until removal is necessary for completion of installation.

10. Couplings shall not be installed except where required pipe runs between other fittings are longer than standard length of type of pipe being installed and except where their installation is specifically reviewed by the ARCHITECT.

11. Water piping shall be installed generally level, free of traps, unnecessary offset, arranged to conform to building requirements, clear of ducts, flues, conduits, and other Work. Piping shall be arranged with valves installed to provide for complete drainage and control of system. Piping shall not be installed which causes an objectionable noise from flow of water therein under normal conditions. Refer to Section 23 0500: Common Work Results for Plumbing.

12. Water lines may be installed in same trench with sewer lines, provided bottom of water line is 12 inches minimum above top and to the side of sewer line.

13. Changes in pipe sizes shall be furnished with eccentric reducers, flat on top. Offsets to clear obstruction shall not be installed so as to produce air pockets.

C. Pipe Sleeves and Plates:

1. Provide pipe sleeves of Schedule 40 black steel pipe or Schedule 40 PVC plastic pipe in concrete or masonry walls, footings, and concrete floors below grade. Provide adjustable submerged deck type sleeves at locations where pipes pass through concrete floors, except concrete slab floors on grade, and at locations where soil pipe for floor type water closets passes through concrete floors.

2. Sleeves shall provide ½ inch clearance around pipes, except plastic pipe shall have 1 inch clearance. Caps of deck type sleeves shall be removed just prior to installation of pipe. Area around sleeves shall be smooth and without high or low spots. Sleeves in walls shall not extend beyond exposed surface of wall. Sleeves in concrete floors and walls shall be securely fastened to forms to prevent movement while concrete is being placed.

3. Piping installed on a roof shall clear the roof surface by 10 inches minimum, with or without insulation. Bottom of individual fittings may infringe on 10 inches clear space but not groups of fittings or fittings located within 27 inches of each other.

4. Stiles shall be provided to facilitate crossing of piping when parallel piping runs are laterally greater than 12 inches out-to-out, or any pipe is higher than 18 inches, and more than 40 feet long or runs between two or more major pieces of equipment or housings greater than 20 feet apart. Stiles shall be not less than 20 inches wide with a minimum tread depth of 10 inches. Where stiles are required, they shall be located so greatest obstructed distance is 30 feet.

5. Where pipes pass through waterproofed walls, floors, or floors on grade, sealant with Link-Seal Modular Seals, or equal, between pipe and sleeve to provide a waterproof joint. Where earth is in contact with pipe on both sides of a wall or foundation, the waterproof joint is not required. Commercial rubber compression units may be furnished instead of sealed sleeves if reviewed by the ARCHITECT.

6. A swing joint, or other required device, shall be furnished and installed in hot water lines with 10 feet of sealant or compression joint to allow for expansion.

7. Provide polished, chrome-plated flanges when plumbing pipes pass through walls at plumbing fixtures, etcetera as specified in Section 22 4000 Plumbing. Provide polished steel, chromium-plated split floor and ceiling plates at

locations where pipes pass through walls, floors, ceilings, and partitions in finished portion that neatly conceals pipe insert.

8. Pipe sleeves shall be provided where pipes intersect footings or foundation walls and sleeve clearances shall provide for footing settlement, but not less than one inch all around pipe.

D. Welding of Pipe and Qualifications of Welder:

1. Joints above grade or accessible conduit or tunnels in steel piping may be either welded or screwed unless specifically indicated otherwise on Drawings or specified. Joints in below grade steel piping, whether in insulation or not, shall not be welded, unless otherwise indicated.

2. Welded joints in pipe shall be continuous around pipe and shall comply with ASME B31: Code for Pressure Piping, unless otherwise specified.

3. Each pipe weld shall be stamped with welder's identification mark. Welding shall be performed by welders possessing a valid certificate of qualification for welding carbon steel welding pipe in horizontal position (2G) and horizontal fixed position (5G) in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code, by an OWNER-recognized, DSA approved testing laboratory.

4. Before any welder performs welding on the Work, furnish the INSPECTOR with a copy of welder's valid qualification papers and obtain verification. Welder qualification is not valid unless it has been issued while welder was performing work for current employer, and has performed type of work described by qualification in the preceding 3 months.

5. Welding performed under these Specifications is subject to special tests and inspections including rigid Ultra Sonic Testing (UT) and radiographic inspection at random, in accordance with Technique for Radiographic Examination of Welded Joints by an OWNER recognized, DSA approved testing laboratory.

E. Unacceptable Welds and Repairs to Welding:

1. Welds containing any of the following types of imperfections shall be deemed defective Work:

a. Cracks of any type.

b. Zones of incomplete (in excess of 1/32 inch) fusion or penetration.

c. Elongated slab inclusions longer than 1/4 inch.

d. Groups of slag inclusions in welds having an aggregate length greater than thickness of parent metal in a length 12 times the thickness of the parent metal.

e. Undercuts greater than 1/32 inch.

f. Overlaps, abrupt ridges or valleys.

3. When a defective weld is detected by examination as outlined above, two additional welds shall be radiographed at locations selected by the Project Inspector. If the two selected welds demonstrate compliant welding, then the two tested welds shall be deemed to be in compliance. Welding revealed by radiographs to be defective Work shall be removed, repaired, and tested by radiograph.

4. If either of the two selected welds demonstrates welding deemed to be defective Work, all welding in that portion of the Work shall be deemed defective Work and either: all welds shall be cutout, prepare new ends for welding and weld to comply with this Specification, or radiograph all welds, removing and repairing only such welding deemed to be defective Work.

5. Repair welding shall be performed in a manner in full compliance with ASME B31. The welded joints or repairs shall be spot examined with UT or radiographic tests in accordance with foregoing requirements.

6. OWNER shall cause to be performed additional random UT and radiographic examinations of welds. OWNER shall be responsible for the costs of any UT and radiographic examinations found to be in compliance with specified requirements.

7. Installer shall be responsible for the costs of UT and radiographic re-examinations of welds deemed defective Work and not in compliance with this Specification, and shall repair or replace said welds in accordance with specified requirements.

F. Welding Rods: Submit a written list of materials and proposed type of welding rods.

G. Backing Rings: Backing rings may be submitted for installation provided the Product Data is submitted with the material list.

H. Qualification Tests for Low-pressure Welding:

1. Tests shall be performed on 3-inch standard weight pipe ASTM A53, Grade A, and shall be welded by acetylene and electric arc. Each sample shall consist of 2 pieces, each 10 inches long, with 30-degree bevel at point weld.

2. Two 20-inch samples shall be performed in the 2G and two 20-inch samples in the 5G positions, with positions defined in Section IX, ASME Boiler and

Pressure Vessel Code. Welds shall have the reinforcement ground or machined flush to the surface of the pipe before testing. Samples shall be tested as full section tensile.

3. Weld shall develop a load of 90 percent of 50,000 psi, i.e., 45,000 psi or shall develop a fracture in parent metal.

4. Each qualified welder shall carry an identification card listing welder's name, date of test, and type of welding tests passed; signed by the welder and the laboratory.

5. A valid certificate of qualification issued in compliance with requirements of the ASME Boiler Pressure Vessel Code Section IX shall qualify a welder for issuance of a certificate for low-pressure pipe welding.

I. Certificates of Qualification for Welding of Unfired Pressure Vessels:

1. Certificates of qualification shall be issued by a laboratory recognized by the OWNER in compliance with the requirements of the ASME Boiler Pressure Vessel Code Section IX. Qualifications shall be for both acetylene and arc welding of Schedule 40 ASTM A53, Type B, steel welded or seamless pipe in the Horizontal Position (2G) and the Horizontal Fixed Position (5G) as defined by said code.

2. Certificate described above is not valid unless it has been issued while welder was working for his current employer, and unless welder has performed type of work described by certificate in the preceding three months. Requirements for possession of a valid certificate shall not be waived for welders fabricating unfired pressure vessels when the Specifications require compliance with ASME code or when welding pipe carries working pressures greater than 75 psi and temperatures greater than 250 degrees F.

J. Pipe Joints and Connections:

1. Pipe and tubing shall be cut per IAPMO Installation Standards. Pipe shall have rough edges or burrs removed so that a smooth and unobstructed flow shall be provided.

2. Hot tapping of gas lines is strictly prohibited.

3. Threaded Pipe: Joints in piping shall be installed according to the following service schedule:

a. Soap Piping: Litharge and glycerine, or Expando, Gasoila, or equal.

b. Plastic Piping: Teflon pipe joint compound tape.

c. Oxygen Piping: Wash treads with S.P., rinse, blow-dry and apply litharge and glycerine.

d. Cleanout Plugs: No compound shall be used. After inspection and test, plugs shall be removed, cleaned, greased, and replaced.

e. Other services furnish sealant, suitable and as reviewed by the ARCHITECT.

4. Threads on pipe shall be cut with sharp, clean, unblemished dies and shall conform to ANSI/ASME B2.1 for tapered pipe threads.

5. Joint compounds shall be smoothly placed on male thread and not in fittings. Threaded joints shall be installed tight with tongs or wrenches and sealant of any kind is not permitted. Failed joints shall be replaced with new materials. Installation of thread cement or sealant to repair a leaking joint is not permitted.

6. Sharp-toothed Stillson, or similar wrenches, is not permitted for the installation of brass pipe or other piping with similar finished surfaces.

K. Copper Tubing and Brass Pipe with Threadless Fittings:

1. Silver brazed joints shall be used for attaching fittings to non-ferrous metallic refrigerant piping.

2. Non-pressure gravity fed condensate lines may be soldered with 95/5 solder.

3. Silver brazing alloy, Class BCUP-5. Surfaces to be joined shall be free of oil, grease, and oxides. Socket of fitting and end of pipe shall be thoroughly cleaned with emery cloth and wiped to remove oxides. After cleaning and before assembly or heating, flux shall be installed to each joint surface and spread evenly. Heat shall be applied in accordance with instructions in the Copper Tube Handbook issued by Copper Development Associates. Joints constructed of rough bronze fittings shall be provided as recommended by manufacturer.

4. Do not overheat piping and fittings when installing silver brazing.

5. Joints in non-ferrous piping for services not covered above shall be installed with solder composed of 95/5 tin/antimony, ASTM B32, Grade 5A. Surfaces to be jointed shall be free of oil, grease, and oxides. Sockets of fitting and end of pipe shall be cleaned with emery cloth to remove oxides. Solder flux shall be sparingly installed and solder added until joint is completely filled. Do not overheat. Excess solder, while plastic, shall be removed with a small brush in order to provide an uninterrupted fillet completely around joint. Random inspection of joints shall be conducted by Project Inspector to ensure joints are lead-free.

6. Grooved end joints for copper piping shall be assembled in accordance with the latest manufacturer recommendations. Pipe ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. Grooving tools shall be as manufactured by Victaulic, RIDGID, MAG Tool, or equal.

7. Pressed fittings for copper or copper alloy pipe or tubing shall have an elastomeric O-ring that forms the joint. The pipe or tubing shall be fully inserted into the fitting, and the pipe or tubing marked at the shoulder of the fitting. Pipe or tubing shall be cut square, mechanically cleaned and reamed prior to joining to remove all burrs (interior and exterior) and restore full inside diameter and a smooth, chamfered exterior surface. The fitting alignment shall be checked against the mark on the pipe or tubing to ensure the pipe or tubing is inserted into the fitting. The joint shall be pressed using the tool recommended by the manufacturer.

L. Ring-Type Pipe: Joints shall be installed in accordance with manufacturer's instructions with grooved couplings, fittings and rubber rings. Couplings and pipe shall be compatible and of the same manufacturer. Rings shall be accurately located and installed by grooves in coupling. Pipe shall be installed with zero deflection unless otherwise specified. Pressure pipe shall be furnished with thrust blocks at each offset point.

M. Welded Pipe Joints:

1. Joints in welded steel pipelines shall be installed by oxyacetylene or electric arc process. Welding shall be continuous around pipe and provided as specified.

2. Butt welds shall be of the single V-type, with ends of pipe and fittings beveled approximately 37 ½ degrees. Piping shall be aligned before welding is started with the alignment maintained during welding.

3. Welds for flanges and socket fittings shall be of the fillet type with a throat dimension not less than pipe wall thickness.

N. Grooved End Pipe Joints: Grooved end joints for carbon steel piping shall be assembled in accordance with the latest manufacturer recommendations. Pipe ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to grove for proper gasket sealing. Grooving tools shall be as manufactured by Victaulic, RIDGID, MAG Tool, or equal.

O. Joints shall be Vic-Press 304TM, or equal, made with Victaulic Series ‘PFT’ tools and the appropriate sized jaw. Pipe shall be certified for use with Vic-Press 304TM system, and shall be square cut, properly deburred and cleaned, and marked at the required location to insure full insertion into the fittings and/or couplings.

P. Valves: Valves shall conform to the following:

1. Piping systems shall be furnished with valves at points indicated on Drawings and specified, arranged to provide complete regulating control of piping system throughout building and the Project site.

2. Valves shall be installed in a neat grouping, so that parts are easily accessible and maintained.

3. Valves shall be full size of line in which they are installed, unless otherwise indicated on Drawings or otherwise specified, and shall be one of types specified.

4. Provide chain operators on valves 2-inch and larger located 7 feet or more above the servicing floor level.

5. Valves for similar service shall be of one manufacturer.

6. Except where otherwise specified, valves shall be Belimo, Victaulic, Stockham, Crane, Jenkins, Milwaukee, Hammond, American, NIBCO, Hoffman, or equal.

7. Ball valves below grade in yard boxes shall have stainless steel handles.

8. Hose bibs in dense garden areas shall be ¾ inch in size with one hose bib in the lunch pavilion 1 inch in size. Other hose bibs shall be ¾ inch lock shield type. Bibs shall be furnished with vacuum breaker protection.

9. Safety valves and pressure relief valves shall have stamp of approval as required by ASME and shall be provided with annual test lever. Where a hot water storage tank is heated by means of a coil, pressure relief valve shall have a steam BTU discharge rating of the coil. Discharge pipe from safety or pressure relief valves shall be not less than one pipe size larger than inlet pipe size of valve. Discharge pipe shall terminate as indicated and shall be free of traps. In addition to locations specified, pressure relief valves shall be installed in the following locations:

    a. On discharge side of each pressure-reducing valve.

    b. On each water heater connected to a hot water storage tank and other pressure vessels.

    c. On cold water line to each water heater or hot water storage tank when there is a check valve, backflow prevention valve or similar device between water heater or hot water storage tank and meter or relief valve at the pressure reducing valve assembly.

    d. On discharge side of each air compressor.

    e. On each air receiver connected to an air compressor.

10. Temperature relief valves and combination temperature and pressure relief valves shall be as specified and furnished as set forth in this Section. Discharge pipe from relief valves shall be not less than discharge area of valve or valves it connects, based on discharge area of valves, and shall terminate as indicated and free of any traps. Valves shall be installed at following locations:

11. A combination temperature and pressure relief valve or combination of valves on each heating hot water storage tank. Temperature sending element shall extend into water inside tank.

12. Manual air vent valve assemblies shall be installed at each high point of hot water space heating and chilled water piping systems. Valves shall discharge through 1/4 inch diameter copper tubing and drain to nearest floor sink. Automatic type air vent valve shall only be installed where specifically indicated. Radiator, convectors, and finned pipe convectors shall be fitted with packless radiator valves, angle or straight pattern. Each convector or radiator installed as part of a space hot water heating system shall be furnished with a manual-type air vent valve.

Q. Strainers: Strainers shall be installed on each water main (except for fire line) downstream of the meter, above grade, when a pressure regulator assembly is not installed. Main strainer shall be of Y-flange or groove type. On closed loop chilled and heating hot water systems pump systems, a strainer shall be installed at each pump inlet and upstream of each flow control valve assembly. The control valve assembly may include a modulating temperature control valve and a flow-limiting valve, manufactured by Griswold, AutoFlow, Flow Control Industries, Inc., or equal.

R. Hangers and Supports:

1. Piping shall be securely fastened to building structure by approved iron hangers, supports, guides, anchors, and sway braces to maintain pipe alignment to prevent sagging and to prevent noise or excessive strain on piping due to uncontrolled or seismic movement under operating conditions. Hangers and supports shall conform to Manufacturer’s Standardization Society Specification SP-69. Hangers shall be relocated as required to correct unsatisfactory conditions that may become evident when system is placed into operation. Appliances, heat exchangers, storage tanks, and similar equipment shall be securely fastened to structure in accordance with seismic requirements. Outdoor metal hangers and supports shall be hot-dipped galvanized steel, unless otherwise specified.

2. Hose faucets, compressed air outlets, and similar items at ends of pipe branches shall be rigidly fastened to building construction near point of connection.

3. Piping shall not be supported by wire, rope, wood, plumbers' tape, or other non-recognized devices.

4. Hangers and supports shall be designed to support weight of pipe, fittings, weight of fluid and weight of pipe insulation, and shall have a minimum factor of safety of five, based on ultimate tensile strength of material installed.

5. Burning or welding of any structural member under load is not permitted. Field welding not specified on Drawings or reviewed Shop Drawings is not permitted without review by ARCHITECT and DSA.

6. Burning holes in beam flanges or other structural members is not permitted without review by the ARCHITECT and DSA.

7. Pipe hangers on piping covered with low temperature insulation shall be installed on outside of insulation and not in contact with pipe unless otherwise detailed on Drawings. Insulation shall be protected by 18 gage galvanized steel shield, with a minimum length of 10 inches, installed completely around pipe covering between covering and hanger. Installing hangers directly on pipe and butting adjoining sections of insulation against hanger is permitted provided void and hanger rod are properly insulated and sealed so that no sweating occurs at hangers.

8. Hanger rods shall be fastened to structural steel members with suitable beam clamps. Clamps shall be Tolco, Carpenter & Patterson, Fee and Mason, or equal, as follows:

    a. Tolco I beam, Fig.62 for maximum 1000 pounds.

    b. Tolco I or WF beam, Fig. 329, for maximum of 1290 pounds.

9. Hanger rods shall be fastened to concrete inserts in concrete slabs or beams. Inserts shall be Tolco, Carpenter & Patterson, Fee and Mason, or equal, as follows:

    a. Tolco Fig.310 for maximum of 600 pounds.

    b. Tolco Fig. 309 for maximum of 1140 pounds.

10. For fastening to wood ceilings, beams, or joists, furnish Grinnell Fig. 128R, Grinnell Fig. 153, Tolco 78, or equal pipe hanger flange fastened with drive screws. Under wood floors, 3/8 inch hanger rods shall be hung from 2-inch by 2-inch by 1/4 inch angle clips 3 inches long, with 2, staggered 10d nails, clinched over joist.

11. Hanger rod sizes for copper, iron, or steel pipe: 3/8 inch for pipe sizes ½ inch through 2-inch, ½ inch for pipe sizes 3-inch, 4-inch and 5-inch, 5/8 inch for pipe size 6-inch, and ¾ inch for 8-inch and 10-inch pipe.

12. Turnbuckles, if furnished, shall provide a load carrying capacity equal to that of the pipe hanger with which they are being installed.

13. Pipe hangers shall be of same size, or nearest larger manufactured size available, as pipe or tubing on which they are being installed.

14. Hangers, clamps, and guides furnished for support of non-metallic pipe shall be padded with 1/8 inch thick rubber, neoprene, or soft resilient cloth.

15. Where special pipe-supporting requirements in the Specifications conflict with any standard requirements specified herein, the Specification requirements shall govern.

16. Vertical Piping:

    a. Vertical pipe risers shall be securely supported with riser clamps of recognized type. Risers in reinforced concrete buildings shall be furnished with extension clamps fastened to pipe above each concrete floor slab with extended arms of clamp to rest on slab. Clamps shall be provided with lead or Teflon liners when installed on copper tubing. Clamps shall be plastic-coated when installed on non-ferrous pipe or tubing.

    b. Copper tubing in sizes 1 ½-inches and larger and steel pipelines passing up through building shall be supported at each floor of building or every 15 feet whichever is less.

    c. Copper tubing sizes 1 ¼-inches and smaller shall be supported at not intervals not more than 6 feet on center. Special provisions shall be installed for vertical lines subject to expansion and contraction caused by operating temperature differences.

    d. Vertical cast iron pipelines shall be supported from each floor and at its base. Malleable iron or steel pipe clamps with minimum thickness of 1/4 inch shall be furnished and fastened around pipe for support.

17. Horizontal Piping:

    a. Roof Mounted Piping: Pressure and non-pressure piping shall be supported from channels, stands, clamps, trapezes, rollers, or structures mounted on 100% rubber, UV resistant rooftop supports with reflective strips, Dura-Block, or equal. Roller type supports shall be provided below and above pipe to prevent its dislodgement. Bottom of pipes shall clear the roof surface by 10 inches.

    b. Insulated steam and space heating hot water insulated condensate lines, insulated domestic hot water supply and return piping shall be supported with Tolco Figure 4, B-Line Figure B3140, Grinnell Figure 212, or equal, steel hangers with welded eye rods to permit hinge movement at point of attachment of hangers. Hinge movement at point

of support shall be provided by welded eye linked rods Tolco Figure 101L, B-Line Figure B3211X, Grinnell Figure 278, or equal.

c. Domestic cold water piping, water supply and return piping, condenser water piping, insulated refrigerant piping gas piping, compressed air piping, cast iron soil piping, galvanized steel vents, waste and downspout piping and glass to be supported with Tolco Figure 1, B-Line Figure B3100, Grinnell Figure 260, or equal, hangers with rods, turnbuckles and inserts suitable for above hangers.

d. Maximum hanger and support spacing shall conform to CPC schedule for horizontal piping installed above grade.

18. A hanger or support shall be installed close to the point of change in direction of a pipe run, in either a horizontal or vertical plane.

19. When practicable, supports and hangers for cast iron soil pipe shall be installed as close as possible to joints and when hangers or supports are not located within one foot of a branch line fitting, an additional hanger or support shall be installed at fitting.

20. In systems where grooved piping is used, couplings shall be provided with angle pattern bolt pads to comply with support and hanging requirements of ANSI/ASME B31.1, ANSI/ASME B31.9, and NFPA Pamphlet 13.

S. Flashings:

1. Each pipe, duct, or gas-fired equipment vent passing through roof shall be installed with waterproof flashing.

2. Flashing or flanges on pipes, vents, and ducts passing through a tile or slate roof shall be constructed of sheet lead. Flashing for pipes and heater vents passing through a roof shall be 4 pound soft sheet lead. Flashing and flanges for ducts and heater vents passing through exterior walls shall be 22 gage sheet metal. Install caps on top of heater pipes. Flanges and flashing shall be installed waterproof at point of connection with pipe or duct. No soldered joints on roof flashings will be allowed. No Stoneman lead roof flashings will be allowed.3. Lead flashing and flanges shall be constructed of 4 pound sheet lead with burned joints. Flange of lead flashing or lead flange on a duct shall extend out onto roof a minimum of 12 inches from pipe or duct. Lead flashing shall extend up the pipe or duct not less than 8 inches.

3. Sheet metal flashing shall be constructed of 24 gage galvanized sheet steel. Flanges on these flashings shall extend out onto roof a minimum of 10 inches from pipe or duct. Flanges on ducts through exterior walls shall extend out from duct a minimum of 2 ½ inches. Flanges on gas-fired equipment single-wall vents shall be of ventilated type. Type B gas vents through a roof shall be furnished with non-ventilated flashing as per NFPA Pamphlet 211.

4. Cast iron, steel, brass, and copper pipe, which terminates less than 18 inches above roof, shall be furnished with a combination counter-flashing and vandal-proof hood for protection against water, birds and foreign matter. Cast iron, steel, brass and copper pipe, which does not terminate within 18 inches of roof, shall be furnished with a counter-flashing sleeve. Pipe, which terminates more than 18 inches above roof, shall be furnished with protection against entrance of water, birds, and foreign matter.

5. Counter-flashing and combination counter-flashing sleeves and vandal-proof hoods shall be cast iron, vandal-proof, threaded, sealed or approved gas-heated sleeve type. Counter-flashing sleeves on each of these items shall extend down over flashing a minimum of ¾ inch.

6. Flashing and flanges on ducts shall be installed waterproof at point of connection to the duct by riveting and soldering. Storm collars shall be securely screwed and installed waterproof around appliance vent pipe immediately above flashing.

7. Vent piping above roof shall be furnished with a combination counter-flashing sleeve and vandal-proof hood.

T. Equipment Installation: Install roof or floor mounted equipment on level platforms, housekeeping pads or curbs and provide sound, vibration and seismic control measures per Section 23 0548 even if not indicated on Drawings.

END OF SECTION

SECTION 22 0553

PLUMBING IDENTIFICATION

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Marking and identification on mechanical piping systems, ducts, controls, valves, and apparatus.

B. Related Requirements:

1. Division 01: General Requirements.

2. Section 22 0513: Basic Plumbing Materials and Methods.

3. Section 22 1000: Plumbing.

4. Section 22 2013: Plumbing Piping.

1.02 SUBMITTALS

A. Submit in accordance with Division 01 and Section 22 0500: Common Work Results for Plumbing.

B. Submit product data and installation instructions for each item specified.

C. Submit Samples of materials.

1.03 QUALITY ASSURANCE

A. Comply with provisions of:

1. Section 22 0500: Common Work Results for Plumbing.

2. ANSI/ASME A13.1: Scheme for the Identification of Piping Systems.

3. APWA: Uniform Color Code.

4. IAPMO: Uniform Plumbing Code (UPC)

PART 2 – PRODUCTS

2.01 MATERIALS

A. General: Piping systems, controls, valves, apparatus, etc., except those that are installed in inaccessible locations in partitions, walls, and floors, shall be permanently identified.

2.02 VALVES

A. Furnish prepared chart or diagram for each piping system, indicating by identifying letter or model number of each valve in the system, its location, and function.

B. Install charts in aluminum frame with clear glass front and secure on wall where designated by the Project Inspector.

C. Bind copies of each chart in operating instructions manual.

D. Provide each valve with a brass, aluminum, or plastic disc, not less than 1-1/4 inches diameter bearing engraved numbers corresponding to those indicated on chart. Fasten discs to valve with No. 14 brass wire.

E. Provide an additional tag for safety valves and other valves that could be hazardous to safety and health of occupants. Distinguish these tags from regular valve tags by color (such as yellow with black letters, and marked "Danger"); submit Sample tag to the Architect for review.

2.03 INSTRUMENTS AND CONTROLS

A. Identify panel-mounted instruments and controls with engraved bakelite nameplates permanently affixed to panel boards.

B. Identify alarm indicating devices and alarm reset devices by nameplates.

C. Identify automatic valves, flow switches, and pressure switches, with embossed aluminum or plastic tape affixed to controller, indicating service and setting.

2.04 EQUIPMENT

A. Identify each major piece of equipment with engraved bakelite nameplates permanently affixed to the equipment, indicating the room numbers it services, Equipment identification designation shall be the same to its designation indicated on the “As-Built Drawings”. Room numbers in the nameplates shall correspond to the final room numbers.

2.05 ABOVE GRADE PIPE IDENTIFICATION

A. Identify pipes by means of colored labels with directional flow arrows and identification of the pipe content, in conformance to ANSI/ASME A13.1 or the UPC.

B. Materials: Precoiled acrylic plastic with clear polyester coating, all-temperature, self-adhering, as manufactured by Brady, Brimar Industries, Seton, Stranco, Inc., or equal.

C. Size:

Outside Diameter of Pipe or Insulation (in inches)	Length of Color Field (in inches)	Size of Letter (in inches)
¾ to 1 ¼	8	½
1 ½ to 2	8	¾
2 ½ to 6	12	1 ¼
8 to 10	24	2 ½
over 10	32	3 ½

D. Locations:

1. On accessible piping, whether insulated or not (including mechanical rooms, attic and ceiling spaces); except that labels shall be omitted from piping where contained material is obvious due to its connection to fixtures (such as faucets, water closets, etcetera.).

2. Near each valve and branch connection in such accessible piping.

3. At each pipe passage through wall or floor.

4. At not more than 20 feet spacing on straight pipe run between bands required in 2 and 3 above.

5. At each change in direction.

E. Application: Install on clean surfaces free of dust, grease, oil, or any material that will prevent proper adhesion. Replace non-adhering or curling labels with new labels.

F. Color Schedule:

Content of Pipe	Legend	Background Color	Lettering Color
Domestic cold water	Domestic. C.W.	Green	White
Non-potable cold water	Caution: Non-potable Water Do Not Drink (1)(2)	Purple	Black
Domestic hot-water 140ºF	Domestic H.W. 140ºF	Blue	Black
Sanitary waste	San waste	Green	White
Sanitary vent	San vent	Green	White
Storm drain or	Storm drain	Green	White

downspout			
Indirect drain	Ind drain	Green	White
Sump pump discharge	Pump discharge	Green	White
Fire sprinkler supply	Fire Sprinkler supply	Red	White
Fire sprinkler drain	Sprinkler drain	Red	White
Fuel oil	Diesel oil	Yellow	Black
Gas	Gas	Yellow	White
Reclaimed Water	Caution: Reclaimed Water Do Not Drink (1)(3)	Purple	Black

H. Notes on Schedule:

1. Note (1) indicates 2 ¼ inch by 1 inch yellow label with ½ inch letters reading UNSAFE WATER at one end of primary label.

   Note (2) words should read "CAUTION: NONPOTABLE WATER DO NOT DRINK." with international *do not drink* symbol.

   Note (3) words should read "CAUTION: RECLAIMED WATER DO NOT DRINK." with international *do not drink* symbol.

2.06 UNDERGROUND PIPE

A. Detectable Marking Tape:

1. Provide and install detectable marking tape along buried piping. Tape shall be specifically manufactured for marking and locating underground utilities with electronic equipment. Tape shall be acid and alkali resistant, and manufactured with integral wires or foil backing, encased with protective cladding. Tape shall be a minimum of two inches in width.

2. Manufacturer: Reef Industries, Inc., Advantage Brands, Inc., Northtown Company, Mutual Industries, Inc., or equal.

3. Detectable marking tape shall be color-coded per APWA Color Code:

   a. Yellow: Oil and gas.

   b. Blue: Water, irrigation and slurry lines.

   c. Green: Sewer and drain lines.

B. Tracer Wire:

1. Solid copper wire type THWN, 12 AWG gauge, with heat and moisture resistant insulation.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Correct detrimental conditions prior to commencing the Work of this Section. Install markers and identification tags as specified with materials and installation procedures recommended by manufacturer.

B. Place tracer wire on top of non-metal utility lines allowing some slack. Do not wrap tracer wire around pipe. Fasten tracer wire in place at approximately 10 feet on centers with non-metal ties.

C. Install underground detectable pipe marking tape continuously buried 8 to 10 inches above the buried utility pipe. Wrap tape on pipe risers up to a height of 12 inches above grade.

3.02 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 22 0700

PLUMBING INSULATION

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Insulation for plumbing piping.

B. Related Requirements:

1. Division 01: General Requirements.

2. Section 22 0500: Common Work Results for Plumbing.

3. Section 22 0513: Basic Plumbing Materials and Methods.

4. Section 22 0553: Plumbing Identification.

5. Section 22 1000: Plumbing.

1.02 REFERENCES

A. American Society for Testing and Materials International (ASTM):

1. ASTM C302 - Standard Test Method for Density and Dimensions of Preformed Pipe-Covering-Type Thermal Insulation.

2. ASTM C411 - Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

3. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

4. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

5. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.

6. ASTM C1104 - Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.

7. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

8. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. Underwriters Laboratories, Inc.

1. UL 723 - Test for Surface Burning Characteristics of Building Materials.

C. National Fire Protection Association:

1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. California Code of Regulation Title 24.

1. California Green Building Standards Code.

1.03 SUBMITTALS

A. Submit in accordance with Division 01 and Section 22 0500: Common Work Results for Plumbing.

1. Complete material list of items to be furnished and installed under this Section.

2. Manufacturer's specifications and other data required demonstrating compliance with the specified requirements.

3. Shop Drawings, catalog cuts and manufacturer's data indicating insulation, jacketing, adhesives, and coating. Insulating materials shall be certified by manufacturer to comply with the California quality standards for insulating materials.

4. Display sample cutaway sections.

5. Manufacturer's recommended method of installation procedures, which will become part of this Section.

1.04 QUALITY ASSURANCE

A. Qualifications of Manufacturer and Installer, Materials, Fabrication, Execution, and Standard of Quality: Comply with provisions stated under Section 22 0500: Common Work Results for Plumbing and Section 22 0513: Basic Plumbing Materials and Methods.

B. Insulation Work shall be in accordance with the California Building Energy Efficiency Standards, CBC, and Uniform Mechanical Code and the California Green Building Standards Code.

C. Test Ratings:

1. Comply with provisions stated under Section 22 0500 and 22 0513 with emphasis on ASTM E84, NFPA 255, or UL 723. ASTM C167, ASTM C302, UL label or listing of satisfactory test results from the National Institute of Standards and Technology, or a satisfactory certified test report from an acceptable testing laboratory. Approval by the State Fire Marshal is required.

2. Furnish labels, legibly printed with the name of the manufacturer or listings indicate that fire hazard ratings do not exceed those specified for materials proposed for installation. Flame spread index of not more than 25 and smoke developed rating not exceeding 50.

3. Tests shall be performed on each item individually when insulation, vapor barrier covering, wrapping materials, or adhesives are installed separately at the Project site.

4. Test insulation, vapor barrier covering, wrapping materials and adhesives as an assembly when they are factory composite systems.

D. Regulatory Requirements: Insulation furnished and installed under this Section shall meet minimum legal requirements of the Building Energy Efficiency Standards adopted and incorporated in the California Energy Commission, Title 24, Part 2, Chapters 2 through 53 and the California Green Building Standards Code unless otherwise noted, for the piping,

E. Chemically based products such as sealers, primers, fillers, adhesives, etcetera must meet the California air quality regulations.

1.05 PRODUCT HANDLING

A. Protection, Replacement, Delivery and Storage: Comply with provisions stated under Sections 22 0500: Common Work Results for Plumbing and 22 0513: Basic Plumbing Materials and Methods.

PART 2 – PRODUCTS

2.01 MATERIALS

A. General:

1. Insulating material shall be fire resistant, non-corrosive, shall not break, settle, sag, pack or disintegrate under vibration, nor absorb more than 1 percent moisture by weight.

2. Insulating material shall be furnished with thickness indicated in Table 1, and shall furnish thermal resistance in the range of R-4.0 to 4.6 in accordance with inch at 75 degrees F. For any other value of R, insulation thickness shall be calculated accordingly and submitted for review.

3. Asbestos in any quantity in insulating material is not permitted.

4. Provide insulation materials, adhesives, coatings, sealants, fitting covers, and other accessories with a fire hazard rating not to exceed 25 for flame spread, 25 for fuel contributed and 50 for smoke developed, except for materials listed as follows:

   a. Nylon anchors for installing insulation to equipment.

   b. Treated wood blocks.

5. Flame-proofing treatments subject to moisture damage are not permitted.

TABLE 1 - MINIMUM PIPING INSULATION THICKNESS (1)

Insulation Thickness Required (in inches)

Piping System Type	Temp. Range (degrees F)	Runouts up to 2 (2)	1 and less	1 to 1.5	1.5 to 4	4 to 8	8 and larger
Service Water Heating Systems (recirculating, piping supply and return)							
Hot Water	Up to 180	1.5	1.5	1.5	2.0	2.0	2.0
Condensate Drain	½ inch minimum insulation thickness.	0.5	0.5	0.5	1.0	1.0	1.0
From A/C Equipment:	Insulate condensate drain lines within building, in room, inside walls and above ceilings.	0.5	0.5	0.5	1.0	1.0	1.0

NOTES: (1) For piping exposed to ambient temperatures, increase thickness by 0.5 inch.

(2) Runouts to individual terminal units, not exceeding 12 feet in length.

B. Lagging Adhesives: Shall be nonflammable and fire-resistant and shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50

when tested in accordance with ASTM E84. Insulation finished with canvas shall be provided with laps adhered in accordance to manufacturer's recommendation. A finish coat of same material shall be applied to entire outer surface of lagging cloth at coverage specified by manufacturer.

C. Canvas Jackets: Provide 6 ounce, in accordance with square foot minimum, 48 by 48 thread count canvas jacketing.

D. Insulation Jackets:

1. Exterior insulation exposed to weather shall be weatherproofed with Childers aluminum jacketing as basis of design, or Pabco, RPR, or equal. Jacketing shall be manufactured from 1100, 3105 or 5010 aluminum alloy with 3/16 inch corrugations. Smooth or embossed jackets may be permitted in special situations to match an existing installation. Jacketing shall be furnished with an integrally bonded moisture barrier over entire surface in contact with insulation. A minimum thickness of 0.016 aluminum jacketing is to be provided on ducts and piping. A minimum thickness of 0.020 shall be provided on tanks, equipment, and heat exchangers.

2. Insulated elbows, of 90 degrees and 45 degrees, with a nominal iron pipe size of ½ inch to 8-inch shall be provided with Childers aluminum Ell-Jacs insulation covers as basis of design, or Pabco, RPR, or equal, manufactured from 1100 aluminum alloy of 0.024 inch thickness. Insulated elbows with a nominal pipe size of 10-inch to 18-inch shall be provided with Childers 4-piece aluminum Ell-Jacs as basis of design, or Pabco, RPR, or equal.

3. Tees, Flanges, and Valve Insulation in Conjunction with Aluminum Jacketing: Furnish Childers Aluminum Special Fabrications Insulation Covers as manufactured by Childers Products Company, Pabco, RPR, or equal.

E. Adhesives: Adhesives shall be water based, UL Classified, meet the requirements of NFPA 90A and NFPA 90B, have been tested according to relevant ASTM requirements, and be acceptable to the State Fire Marshal. Name, type and method of installation shall be submitted for review.

F. Valve and Fitting Cover: When installed in conjunction with PVC jacketing, furnish Zeston 25/50 rated polyvinyl chloride fitting covers as manufactured by Johns Manville, Knauf Insulation, Speedline, or equal.

2.02 DOMESTIC HOT WATER PIPING SYSTEM INSULATION

A. General: Insulate domestic hot water supply and return piping, including valves, strainers and fittings with insulation thickness as indicated on Table 1.

B. Materials:

1. Classes of Insulation:

a. Class A: Glass fiber molded pipe insulation suitable for service temperatures up to 850 degrees F. Pipe insulation shall be one piece, preformed, and provide a minimum R factor of 4.0 at 75 degrees F mean temperature. Insulation shall be faced with all-purpose fire retardant vapor barrier jacket. Pipe insulation shall be Johns Manville Micro-Lok, Knauf Redi-Klad 1000, Owens Corning FIBERGLAS Pipe Insulation SSL II-ASJ, or equal.

b. Class B: Flexible open-cell melamine (foam insulation) suitable for service temperature -150 degrees F to 400 degrees F. Thermal conductivity at 75 degrees F, K= 0.26. Pipe insulation, one-piece pre-formed, laminated to heavy non-reinforced PVC jacket, with locking track, factory installed to jacket, to snap insulation and jacket onto pipe. Similar to TechLite 079 Series as manufactured by Accessible Products Co., or equal. Installation shall comply with manufacturers recommendations.

c. Class C: Mineral fiber pipe insulation suitable for service temperatures up to 1200 degrees F. Pipe insulation shall be one-piece, preformed up to 3 inches thick, and provide a minimum R factor of 4.0 at 75 degrees F mean temperature. Insulation shall be faced with all-purpose fire-retardant vapor barrier jacket. Pipe insulation shall be 8 pounds in accordance with cubic foot density by Roxul Techton 1200, Fibrex COREPLUS 1200, Industrial Insulation Group, LLC (IIG) MinWool-1200, or equal.

2. Locations and Class of Insulation Required:

TABLE 2 – LOCATIONS AND CLASS OF INSULATION REQUIRED

LOCATION	CLASS OF INSULATION
Equipment Room	A, B or C
Other Locations	A, B or C

3. Fittings on indoor piping shall be covered with flush, hand-wrapped Class A, B, or C insulation, to match the adjoining pipe insulation and covered with polyvinyl chloride fitting covers: Zeston 2000 25/50 by Johns Manville, Knauf Insulation Proto PVC Fitting Cover, Speedline Polyco Smoke Safe, or equal.

4. Adhesive: Fibrous Adhesive to bond calcium silicate to itself and non-porous surfaces.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Except as specified herein, install material in accordance with recommendations of manufacturer. Do not install insulation materials until tests specified in other sections are completed. Remove foreign material such as rust, scale, or dirt. Surfaces shall be clean and dry. Maintain insulation clean and dry at all times.

B. On cold surfaces where a vapor barrier must be provided and maintained, insulation shall be installed with a continuous, unbroken moisture and vapor seal. Hangers, supports, anchors, or other projections that are fastened to cold surfaces shall be insulated and vapor sealed to prevent condensation.

C. Surface finishes shall be extended in such a manner as to protect raw edges, ends, and surfaces of insulation.

D. Pipe or duct insulation shall be continuous through walls, ceiling or floor openings, or sleeves; except where firestop or firesafing materials are required.

E. Metal shields shall be installed between hangers or supports and the piping insulation. Rigid insulation inserts shall be installed between the pipe and the insulation shields. Inserts shall be of equal thickness to adjacent insulation and shall be vapor sealed accordingly.

F. Insulation shall not be installed in the following locations unless otherwise noted:

1. On unions, flanged connections or valve handles.

2 Over edges of any manhole, clean-out hole, clean-out plug, and to restrict opening or identification of access.

3. Over any label or stamp indicating make, approval, rating, inspection, or similar data, unless provision is made for identification and access to label or stamp.

3.02 INSTALLATION OF DOMESTIC HOT WATER PIPING SYSTEM INSULATION

A. General: Domestic hot water, tempered water supply and return piping and condensate return piping, after having been tested, shall be cleaned and insulated.

B. Application: Insulate condensate return piping, domestic hot water supply and return, including tempered supply and return piping in accordance with manufacturer's instructions and as specified herein.

1. Install insulation on valve bodies up to valve bonnet. Fill void in saddles, in accordance with Section 22 0513: Basic Plumbing Materials and Methods, with insulation and seal joints.

2. Install insulating material to fittings, valves, and strainers and smooth to thickness of adjacent covering. Leave strainer clean-out plugs accessible. Covers fabricated from polyvinyl chloride shall be furnished.

C. Insulation Jackets in Exposed Indoor Locations:

1. Cover completed insulation with canvas jacket tightly pasted to covering with lagging adhesive. Lap jacket seams 1 1/2-inch minimum. Finish entire jacket with coating of undiluted adhesive.

2. Equivalent factory applied pre-sized, glass fiber reinforced, or glass fiber jackets may be furnished. Seal jacket seams with adhesive in accordance with manufacturer's instructions.

3. Johns Manville Zeston 2000, Knauf Insulation Proto PVC Fitting Cover, Speedline Polyco Smoke Safe, or equal, fitting covers may be furnished, with molded or segmented insulation equal to specified insulation applied to fittings. Secure covers in accordance with manufacturer's instructions.

4. In addition to above requirements, cover exposed insulated piping within a distance of 8 feet above floors with 26 gage galvanized steel jacket. Omit jacket in areas accessible only to maintenance personnel, such as mechanical equipment rooms, utility corridors, accessible pipe tunnels and manholes.

D. Concealed Indoor Locations: Cover insulation over fittings, valves, and strainers with canvas. Provide pipe insulation with factory or field applied standard jacket of 4 ounce minimum canvas, fiberglass cloth, or glass fiber reinforced jacket. Seal jacket laps with adhesive in accordance with manufacturer's instructions.

E. Exposed Outdoors: In addition to canvas or fiberglass cloth cover, pipe insulation exposed to weather shall be provided with an additional 0.016 inches thick aluminum jacket with 2-inch lap connected with one inch hem overlap joint located on side of pipe and turned down to shed water. Jacket shall be strapped 12 inches on center with ½-inch wide stainless steel strapping and wing seals. Aluminum jacket shall be mitered to fit fittings.

3.03 CLEANUP

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 22 1000

PLUMBING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Labor, materials, tools, and equipment to install plumbing systems as indicated.

B. Related Sections:

1. Division 01 - General Requirements.
2. Section 07 9200: Joint Sealants.
3. Section 10 4413: Fire Extinguishers and Cabinets.
4. Section 11 4013: Food Service Equipment.
5. Section 22 0500: Common Work Results for Plumbing.
6. Section 22 0513: Basic Plumbing Materials and Methods.
7. Section 22 0553: Identification for Plumbing piping and Equipment.

1.02 SUBMITTALS

A. Provide in accordance with Division 01 and Section 22 0500: Common Work Results for Plumbing.

B. Provide necessary documentation to Owner for processing rebates for water efficient fixtures.

1.03 QUALITY ASSURANCE

A. Unless otherwise noted, the California Plumbing Code is hereby made part of this section.

B. Conform to provisions of Section 22 0500: Common Work Results for Plumbing.

C. Manufacturer of plumbing products must be third-party certified to ANSI/NSF Standard 61, Section 9 certification, and ANSI/NSF 372 to demonstrate compliance with the federal requirements for lead contribution to drinking water, the Safe

Drinking Water Act SDWA, and the California Health and Safety Code Section 116875.

1.04 PRODUCT HANDLING

A. Conform to provisions of Section 22 0513: Basic Plumbing Materials and Methods.

PART 2 - PRODUCTS

2.01 PIPING SYSTEMS

A. Materials: Refer to Section 22 0513: Basic Plumbing Materials and Methods.

2.02 FIXTURES AND DRAINS

A. General: Fixtures specified shall be furnished complete with trim and fittings. Cast iron plumbing fixtures shall be acid resistant enamel, and identified by casting letters "AR" or words "acid-resistant" into metal. Fixtures shall be white unless otherwise specified. Cast iron fixtures shall be white enamel inside and on back, rim and apron, with exposed unfinished surfaces painted white. Fixtures of same general classifications shall be of same make.

B. Finished Brass:

1. Unless otherwise specified, finished brass of a similar type shall be of same manufacturer and model throughout buildings.

2. Finished and exposed brass equipment, except floor, shower and urinal drains shall be chromium-plated and polished. Floor, shower and urinal drains, unless otherwise specified, shall be nickel-bronze metal.

C. Traps, Trap Arms and Tailpieces:

1. Fixture traps shall be all cast brass, chromium-plated and polished. (No tubular traps). Exceptions as follows:

a. Traps that are an integral part of a fixture.

b. Traps concealed in floors, walls and furring.

c. Traps standard for service sinks and Industrial Shop equipment.

d. Laboratory traps and tailpieces shall be as specified in section 22-0513 “Basic Plumbing Materials and Methods”.

2. Concealed traps and 17 gage tailpieces may be rough brass finish, except as otherwise specified. Laboratory traps and tailpieces shall be as specified in

Section 22-0513: Basic Plumbing Materials and Methods. Furnish chromium-plated and polished cast brass wall flanges with setscrews and chromium-plated and polished brass casing on discharge side of each trap.

3. Tailpieces shall be not lighter than 17 gage, brass, chromium-plated, and polished. Furnish and install chromium brass plated wall flanges with set screws and chromium-plated 20 gage brass casing on discharge side of each chrome-plated all cast trap.

D. Faucet and Shower Valve Handles: Faucet and shower valve handles shall be solid brass, chromium-plated and polished, and fastened to their stems by Allen type hollow head stainless steel set screws through the side of the handle extending into the stem. Handles with sharp edges or projections shall not be furnished. At accessible fixtures: handles shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate handles shall be 5 pounds maximum.

E. Fixture Supplies:

1. Supplies for water heaters shall be unplated rigid copper water tube with threaded adaptors for connections to valves and other threaded connections. All other supplies shall be chromium-plated brass with hospital threads or shall be furnished with fittings and valves, which completely cover threads.

2. Exposed supplies for showers shall be chromium-plated brass pipe up to header with hospital threads or shall be furnished with fittings and valves, which completely cover threads.

3. Supplies to water closet tanks, lavatories, and drinking fountains shall be furnished with a NSF 372/61 threaded brass nipple. Exposed unfinished piping shall be sleeved with chrome plated brass or copper cover casing and have an appropriate escutcheon for a clean finished appearance. Angle/straight valve stops shall be female 1/2 IPS (inlet) by 3/8 compression (outlet). Fixture supplies shall be polished chrome-plated, solid supply bulbed end risers with size compatible supply nut connection to fixture and 3/8 O.D. compression nut and ferrule connection to angle stop outlet. Stainless steel flexible braided connectors with re-enforced PVC inner hose are not allowed.

4. Hot and cold water fitting supply outlet piping serving water closets, urinals, lavatories, drinking fountains, sinks, faucets, hose bibs, and sillcocks shall be iron pipe size (IPS) brass nipple, and piped in such a manner that through wall water supply outlet piping be removable, size appropriate, and lead free. The use of copper, copper MIP sweat adapters or similar fittings, in lieu of brass nipples is not allowed. The IPS brass nipple shall be directly connected to the fixture as follows:

a. Control stops for water closet and urinal flush valves.

b. Angle stop for lavatories, sinks and drinking fountains.

c. Shank/arm adapters for wall mounted sink faucets.

d. Iron pipe size (IPS) brass nipple connection for hose bibs, sillcocks, and other plumbing related fixture and/or plumbing fitting water supply outlets.

5. Water supply pipe that penetrates a finished surface, wall, countertop or part of a cabinet shall be appropriately sized polished chromium-plated cover casing and wall flange/escutcheon fitting tight to the brass through wall nipple and securely affixed to the finished wall surface.

6. Water supplies of plumbing fixtures shall be protected against back-siphonage in event of a vacuum in piping system. Toilet and urinal flush valves shall be furnished with recognized atmospheric vacuum breakers, installed a minimum of 6 inches above fixture.

7. Discharge outlets of supply faucets for lavatories and sinks shall clear top of overflow rim by at least one inch.

2.03 ACCESS PLATES (To cleanouts, valves, water hammer arrestors and hose faucets)

A. Schedule Numbers:

AP-1: Square, unless otherwise noted, steel, prime coated; frame, 18 gage minimum. Door shall be 16 gage minimum with concealed hinge or be removable, with vandal-proof lock operated by Allen wrench. (For painted and stucco walls.)

SMITH	ZURN	ELMDOR	MILKOR	WATTS	MIFAB	JOSAM
Fig 4760 AK	Z-1462-VP	DW-AKL	MOR DW AK1	CO-300-S-6	UA-A	58650-VP OR EQUAL

AP-2: Round type, stainless steel, vandal-proof, 5/16 inch No. 18 or 1/4 inch No. 20 flat-head machine screw into cleanout plug. Plate shall be prime coated minimum 18 gage steel or polished chrome-plated brass, 18-8 No. 302 stainless steel, or polished nickel bronze.
(For painted walls, screwed into cleanout plug.)

SMITH	ZURN	JOSAM	WADE	WATTS	MIFAB	OR EQUAL
4710U	Z-1469-VP	58600	8480R	CO-480-RD-6	C1400-RD-6	

AP-3: Square, polished face chrome-plated bronze, aluminum alloy or brass chrome-plated brass frame with 14 gage polished 18-8 No. 302 stainless steel or brass chrome-plated secured cover with vandal-proof screws. (For tile walls.)

SMITH	ZURN	WADE	WATTS	MIFAB	JOSAM	OR EQUAL

4735U	Z-1460-VP	58630	CO-300-S-6	C1400-S-3-6	58640-VP	

2.04 BACKFLOW PREVENTION ASSEMBLIES

A. Schedule Numbers:

BPV-2: Non-pressure type, atmospheric vacuum breaker, Los Angeles City approved.

WATTS	WILKINS	OR EQUAL
LF288A	35XL	

BPV-3: Reduced pressure or pressure differential type, Los Angeles City approved and in compliance with DWP Rule 16-D for meter protection. Sizes ½ inch to 6-inch.

WILKINS	WATTS	FEBCO	OR EQUAL
375 and 975 XL (for uninterrupted service)	LF009-QT; LF909-NRS	LF860	

BPV-6: Pressure vacuum breakers with 3/4 inch hose bib. Install 6 feet above finished floor.

WILKINS	WATTS	FEBCO	OR EQUAL
420XL	LF008PCQT	LF765	

2.05 CLEANOUT ASSEMBLIES

A. Cleanout plug shall be line size.

B. Schedule Numbers:

CO-1: Iron body cleanout tee full line size up to 4 inches and round access plate, plugs shall be brass, countersunk with tapped boss for 5/16 inch No. 18 or ¼ inch No. 20 screws. (For the use of finished walls at base of waste stack, above urinal and service sink.) AB&I and TYLER may be used as iron body cleanouts. Trim and accessories shall be Smith or Zurn or equal.

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
4532-U	Z-1446-BP	CO-460-RD-34B	C1460-RD-6	58600-CO	

CO-2: Iron body with approved UPC plug, top and adjustable sleeve, cut-off ferrule, polished scoriated brass nickel bronze secured cover. AB&I and TYLER may be used as iron body cleanouts. Trim and accessories shall be Smith or Zurn or equal **(**For the use of finished floors inside buildings, in covered areas, and in concrete paving.)

Square:

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
4053L-U-NB	ZN-1400-T	CO-200-S	C1220-S-1-6	55000-1-SQ	

Round:

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
4033-L-U-NB	ZN-1400	CO-200-R	C1220-1-6	55000-1	

CO-3: Secured cover, extra heavy-duty, adjustable sleeve, cut-off ferule, UPC. Brass approved type plug, scoriated tractor type cover.

(For the use of areas outside building on concrete paving.)

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
4233-U	ZN-1400-HD	CO-200-RX-4	C1220-4-6	55000-22	

2.06 DIELECTRIC UNIONS

A. Schedule Numbers:

1. Dielectric style Unions using ferrous and no-ferrous metals are prohibited. Dielectric flanges are admitted for use – see DU-2.

DU-1: Lead Free Brass union with 6-inch Lead Free Brass nipple.

DU-2: Lead Free Brass union or Lead Free Brass flanged fittings are to be used in between pipes made of dissimilar metals to prevent accelerated corrosion and deterioration in the piping systems due to galvanic and stray current.

WATTS	WILKINS	ZURN	NIBCO	OR EQUAL
LF3100M3			733-LF	

2.07 FAUCETS

A. Access compliant faucets: Force to activate controls shall be no greater than 5 pounds. Self-closing metering, where specified, to remain open 10 seconds minimum when activated. Handles shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist.

B. Schedule Numbers:

F-1: Wall mounted ¾ inch hose-thread spout faucet with vacuum breaker with integral service stops and top wall brace, adjustable eccentric union inlet connections, rough chrome.

(For the use of service sink and can wash.)

CHICAGO	AMERICAN STANDARD	ZURN	OR EQUAL
897-RCF	8344.112-RC	Z843MI-RC	

F-2: Wall mounted stainless steel 8 inch spread faucet with lever handles and 8 inch swing spout with brass free waterways. **(**For the use of food preparation sinks or 3-comp sink.)

FISHER	OR STAINLESS STEEL EQUAL
53112	

F-12: Deck mounted stainless steel 8 inches wide spread faucet, with 8-inch swing spout, aerator and lever handles. (For food preparation sinks or 3-comp sink.)

FISHER	OR STAINLESS STEEL EQUAL
57649	

2.08 FLOOR DRAINS

A. Schedule Numbers:

FD-1: Cast iron body, no hub with seepage pan and flat, round nickel bronze strainers not less than 5-inch diameter for 2-inch outlet bodies, 7-inch for 3-inch outlet bodies and 8-inch for 4-inch outlet bodies, with maximum of ½ inch square holes or slots not larger than ¼ inch by 1 ¼-inch.

(For use in locations other than tile floors.)

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
2005Y-A	ZN-415-B	FD-100-A	F1100-C-1	30000-A	

FD-2: Same as specified for FD-1, except with square tops.

(For use in tile floors.)

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
2005Y-B	ZN-415-S	FD-100-M	F1100-C-S-1	30000-S	

2.09 FLEXIBLE HOSES

A. Schedule Numbers:

FLH-1: Braided stainless steel metal hose (for gas use). US Flex, Metraflex, Nelson Dunn or equal.

FLH-2: Braided bronze metal hose (for non-pressure condensate connection use). US Flex, Metraflex, Nelson Dunn or equal.

2.10 FLOOR SINKS

A. Schedule Numbers:

FS-1: Round, cast iron, acid-resistant enamel body with bottom aluminum dome strainer, less grate.

SMITH	ZURN	WATTS	MIFAB	JOSAM	OR EQUAL
3400Y-10	Z-1950-1	FS-760-22	FS1760-22	49580A	
Strainer	4320.024		K-8807		OR EQUAL

2.11 PIPE HANGERS

A. Refer to Section 22 0513: Basic Plumbing Materials and Methods.

B. Schedule Numbers:

1. PH-1: Complete with clamps, inserts, etc.

SUPERSTRUT	UNISTRUT	TOLCO	B-LINE	OR EQUAL

2.12 P-TRAPS

A. Schedule Numbers:

PT-1: Cast brass complete, chrome-plated.

	AB&A		OR EQUAL
	107		

2.13 SERVICE SINKS and TRIM

A. Schedule Numbers:

Hand Sink: See plan

3-Comp Sink: See plan

2.14 SINKS and TRIM

A. Access compliant faucets for sinks: Force to activate controls shall be no greater than 5 pounds. where specified self closing metering to remain open 10 seconds minimum when activated.

B. Cast iron sinks shall be acid resistant enamel, and shall conform to Commercial Standards CS 77.63. Units furnished in conjunction with strainer installation or faucet installation shall be brass. Exposed brass nuts shall be chrome-plated. Refer to the Fixture Supplies paragraph of this section.

C. Exposed trim shall be free from sharp edges or points. Fixture shall be furnished with other listed manufacturer specified trim. Instead of solid supply pipe, polished chrome-plated risers, 3/8-inches outside diameter with ferrule stop end and metal nosepiece may be furnished.

D. For access compliant sinks: Insulate cold water, hot water and drain pipes under sinks with district approved type insulation.

PLUMEREX	LAV GUARD	OR EQUAL

2.15 STOP VALVES

A. Stops shall be loose key type, ½-inches IPS inlet and outlet chrome-plated brass casting, except as noted.

B. Schedule Numbers:

STV-1: Angle:

CHICAGO,	BRASSCRAFT	NIBCO	OR EQUAL
442-LKABCP		77	

STV-2: Partition:

CHICAGO	T& S BRASS	OR EQUAL
1771-ABCP	B-1028	

STV-3: Straight Type, with Loose Key:

CHICAGO	BRASSCRAFT	T&S BRASS	OR EQUAL
45-LKABCP (1/2 inch)		B-O418	

2.16 THERMOSTATIC MIXING VALVE ASSEMBLIES (TMVA)

A. General: Valve bodies shall be cast brass or bronze valve assembly provided with holding bracket and shall be installed on wall bracket. Valve shall be rough brass or

bronze satin sprayed finish unless otherwise noted. Assembly shall include a 3 5/8-inch diameter dial thermometer, color-coded with white face and black letters. The temperature range between 100 degrees F. and l50 degrees F. shall be background in red or red line enclosed. Valve complete with fail safe feature, square shank loose key stops, checks and strainers on both hot and cold-water inlets and shutoff valve on outlet. Valves shall be sized on a 45 psig (maximum) pressure drop at the following flow rates:

TMVA-1: 5 to 15 GPM.

TMVA-2: 25 GPM.

TMVA-3: 40 GPM.

TMVA-4: 60 GPM.

TMVA-5: 80 GPM.

TMVA-6: 100 GPM.

TMVA-7: 125 GPM.

TMVA-8: 200 GPM.

B. Manufacturers:

POWERS	T & S	LEONARD	BRADLEY	WATTS	OR EQUAL
Type 430 Series Single Valve Hi-Lo (1430 series)	Ultra-Safe	Type TM	Navigator Series High/Low	LFMMV	

2.17 TRAP PRIMERS

A. Schedule Numbers:

ATP-1: Automatic, multi-trap primer, cast bronze with access panel. Pressure drop of three p.s.i. shall activate trap seal primers. Manufactured by MIFAB, or equal. (Installed in accessible location.)

MIFAB	OR EQUAL
MR-500-NPB	

2.18 WATER HAMMER ARRESTORS

WHA-1: Lead Free Water Hammer Arrestor provided for Headers for Lavatories, Wash Sinks, Wash Fountains, Kitchen Sinks, Service Sinks, Urinals and Water Closets. For sizing purposes size according to manufacturer's recommendations.

SIOUX CHIEF	PPP	JR SMITH	WATTS	JOSAM	OR EQUAL
655 and 656 SERIES	SC SERIES	5005 TO 5050 SERIES	Series LF05 and LF15M2	75000	

2.19 FIXTURE CONNECTIONS

A. Branches to individual fixtures shall be of the following sizes (Inches) unless larger sizes are indicated on Drawings:

Fixture	Copper, Cold (Inches)	Copper, Hot (Inches)	Trap and Connections (Inches)	Soil/ Waste (Inches)	Vent (Inches)
Hand Sink	1/2	1/2	2	2	1-1/2
Kitchen Sink	1/2	1/2	1-1/2 by 1-1/2	2	1-1/2
3-Comp Sink	3/4	3/4	2	2	2

2.20 HEIGHT OF FIXTURES

A. Heights for standard fixtures: See plan

B. Heights for access compliant fixtures: See plan

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which Work of this section will be performed. Correct conditions detrimental to proper and timely completion of Work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General:

1. Unless otherwise specified, plumbing fixtures, equipment and appliances that require connections to plumbing line shall be connected. This shall include fixtures specified or indicated as furnished by others, furnished by Owner, or specified in other related sections. Install supplies, stops, valves, traps, wall flanges, or pipe casing for connection of this equipment.

2. Install equipment as indicated on reviewed and accepted Shop Drawings.

3. Avoid interference with Work of other trades. Do not deviate from Drawings without review of the Architect.

B. Examination: Check each piece of equipment in system for defects verifying that parts are properly furnished and installed.

C. For piping Work, refer to Section 22 0513: Basic Plumbing Materials and Methods.

D. Plumbing Fixture and Equipment Installation:

1. Unless otherwise indicated, fixtures shall be installed with 5/16 inch brass bolts or screws of sufficient length to securely fasten fixture to backing, wall, or closet ring.

2. Fixtures installed against concrete or masonry walls shall have their hangers fastened with 5/16 inch brass bolts, Philip Shield type anchors, or 2 unit cinch anchors. Wood or plastic plugs are not permitted.

3. Fixtures installed against wood or metal stud walls shall have their hangers fastened to metal backing plates with 5/16 inch brass bolts screwed into plate. Fixture hangers for urinals shall be fastened centered vertically on metal backing plate with three 5/16 brass bolts each for small individual hangers and six, for larger one piece hangers. Lavatories shall be hung with not less than four 5/16 inch brass bolts or not less than five 1/4 inch brass bolts. Each sink hanger shall be hung with not less than four 5/16 inch brass bolt or not less than five 1/4 inch brass bolts.

4. Backing for hanging of plumbing fixtures and equipment shall be installed in supporting wall at time rough piping is installed. Backing for stud walls shall be steel plate 1/4 inch thick, not less than 4 inches wide. Backing for urinals shall be ¼-inches thick by 6-inch wide steel plate. Steel plate shall be attached to stud at each end of plate and to each stud it crosses. Plate shall be attached to metal studs by bolting with two ¼ inch U-bolts per stud with bolts through plate and around stud flange or by welding with a 1/8 inch fillet weld full width of stud flange, top and bottom of plate. At wood studs, plate shall be carefully recessed flush with face of stud and attached to each stud with 2 No. 14 flat-head wood screws, 2 inches in length into pre-drilled 1/8 inch holes. Backing for stud walls supporting wall-hung closets shall be as detailed.

5. Rough-in for fixtures, equipment and appliances shall be as indicated on Drawings and as specified, including those items indicated as furnished by others, furnished by Owner, or future capacity. When connections to equipment from capped or plugged lines are required, caps or plugs shall be removed at time equipment is set and stops or valves installed and connections provided as specified.

6. Piping materials for trap arms shall be Brass, Cast Iron or DWV copper

7. Piping shall be stubbed out to exact location of fixtures and stubs shall be installed symmetrical with fixtures. Hot and cold water supplies for center set faucets on lavatories shall be installed on 8-inch centers, unless otherwise specified or required.

8. Kitchen equipment requiring backflow protection with hot and cold water connections shall be installed with approved backflow prevention assemblies; BPV-3 and drain into floor sink with air gap.

E. Cleanouts in Drain, Waste, Vent and Sewer Lines:

1. Cleanouts shall be installed at locations stated in the California Plumbing Code and accessible at following locations:

a. At locations above first floor as stated on construction documents and 5 feet outside of the building.

b. Install an accessible main line upper terminal cleanout in all restrooms above water closet over flow. (Install above upper terminal water closet where there are more than one water closet in a restroom).

c. Above faucets of each sink with brass plug.

d. Above service sink with brass plug.

e. At each Drinking Fountain with brass plug.

f. At each urinal and locate above urinal with brass plug.

g. Above overflow level of pot sinks with brass plug.

h. In vertical line at base of each downspout connected to an underground storm drain system extend cleanout to exterior of building.

i. At upper end of a horizontal vent line when any part of horizontal line is below overflow level of fixture it serves.

j. Not to exceed 100-foot intervals in sewer and waste lines exterior of building.

k. At property line connection.

l. Where indicated on Drawings.

2. Cleanouts shall be extended to grade as follows:

a. Not to exceed 100-foot intervals in straight runs of pipe outside buildings.

b. At horizontal changes of direction in aggregate greater than 135 degrees (underground).

c. At property lines.

d. Where cleanouts occur under concrete.

e. Where marked for future connections.

3. Cleanouts in building shall be extended to floor level or above floor level or above floor level in walls or furring when cleanouts are not accessible or where clearance is less than 18 inches.

4. Cleanouts in finished areas in building shall be concealed except that cleanouts above service sinks in janitor's rooms or closet, and cleanouts above service sinks or in exposed piping in boiler or heater equipment rooms, may be exposed. Cleanouts for urinals shall be installed above urinal and shall terminate behind an access plate.

5. Cleanouts in floors of covered areas and those extended to grade in concrete areas shall be floor level type with extensions body brass plugs and detachable nickel-bronze or aluminum alloy scoriated.

6. Concealed cleanouts in vertical lines shall be service weight soil cleanout tees with brass plugs and round cover plates unless otherwise specified or indicated. A snug fitting sleeve of galvanized sheet metal shall be placed around hub of tee and shall extend to flush with finished soil, or cleanout shall be extended to finished wall.

7. Cleanouts extended from below floor to a wall or furring or on horizontal lines above floor that terminate at a wall or furring shall be iron body type with brass plugs and round cover plates.

8. Cover plates over cleanouts in painted walls shall be steel, bonderized and prime coated. Cover plates cover cleanouts in tile walls shall be chromium-plated brass or nickel bronze. Plates shall be attached to cleanout plugs with

5/16 inch No. 18 or 1/4 inch No. 20 stainless steel vandal-proof type screws. Plates shall be one inch larger in diameter than fitting opening.

9. Cleanouts at bases of downspouts shall be tapped soil tees with brass plugs as hereinafter specified, full size of line.

10. Cleanouts extended to grade in exterior sewer lines other than floors or concrete areas shall be a cleanout assembly with secured top, extra heavy-duty, adjustable sleeve, cut-off ferrule, countersunk threaded brass plug and scoriated tractor type cover.

11. Other cleanouts shall be iron body type.

12. Cleanout extensions shall be no-hub cast iron soil pipe. Exterior cleanouts, those in concrete excepted, shall terminate in a 14-inch by 6-inch thick concrete block with cleanout assembly and top of block flush with finish grade.

13. Fittings in lines utilized as cleanouts shall be approved soil fittings including no-hub pipe. Tees and crosses in vent headers excepted.

14. Pipe joint compound shall not be installed on cleanout plug. After lines are tested and approved, each cleanout plug shall be removed, greased, and replaced.

3.03 EXCAVATION, TRENCHING AND BACKFILLING

A. Perform trenching, excavation, and backfilling required for Work of this section as specified herein and in Section 31 2323: Excavating, Backfilling, and Compacting for Utilities.

3.04 SERVICE CONNECTIONS

A. Determine exact location of required water, drain, and sewer connections and provide proper connections.

B. Potable water lines shall be purged completely before connecting to sources of water for the Project. Determine quality of water supply before connection.

3.05 WATER HAMMER ARRESTORS

A. Install water hammer arrestors indicated on Drawings and in following locations (only non-ferrous arrestors may be installed in copper water system):

1. Water lines to lavatory headers, water closet and urinal headers, service sinks, kitchen sinks, wash fountains, drinking fountains, laboratories with

medical type faucets and on wash sinks having three or more stations and all other quick closing fixture such as clothes washers, as close to fixture as possible.

2. Between last two fixtures when three or more fixtures, other than those listed in Number 1 above, are served by a common header.

B. When possible, arrestor shall be installed in wall or furring. When arrestor is installed in wall or furring, furnish an access plate large enough to permit removal of arrestor. Access plate shall be a minimum of 2 inches larger in each direction than the arrestor.

C. Fixture water lines shall be provided with mechanical water arrestor hammer dampening devices. Air chambers are not approved.

3.06 CLEANING - PLUMBING PIPING SYSTEMS AND FIXTURES

A. Plumbing lines and fixtures shall be flushed to remove dirt and foreign material until water runs clear and no foreign substance or odor is present. Strainers and screens on faucets shall be removed during this cleaning operation.

B. After satisfactory cleaning of strainer and screen replacements has been witnessed by the Project Inspector, post and maintain signs stating: "CAUTION - Water at this construction project has not yet been certified for human consumption." Signs shall be furnished with letters at least 1/2 inch in height and shall be conspicuously posted at entrances to the Project site. Signs shall be paneled, black and yellow, in conformance with OSHA Section 1910.1455.

3.07 DISINFECTING DOMESTIC WATER PIPING SYSTEMS

A. Newly installed or replaced piping and/or fixtures dispensing potable water, and any additional piping and/or equipment impacting the integrity of this system shall be disinfected and undergo an approved bacteriological analysis before water system is allowed for public use.

B. Disinfection shall commence upon complete installation of all related domestic water systems including fixtures, valves, faucets, water heating systems, etc.

C. Work shall be performed by Technicians Certified by the American Water Works Association (AWWA) and/or the State of California Department Health Services, Grade II Water Treatment Operator Certification or higher issued by the Department of Health Services (DHS) for the State of California. Comply with Title 22, Code of Regulations Division 4, Chapter 13, and Article 2 Operator Certification Grades.

D. Method:

1. A Physical Separation of minimum 6" or Reduced Pressure Backflow assembly shall be installed to protect from cross contamination of the local water purveyor's meter service supply when at any time there is any type of water connection with the piping to be disinfected (Chlorinated) and the water meter service supply.

2. Install a Chlorination Port including a T fitting and a shut off valve to the proximity of the point of connection at the new piping system.

3. System is to be flushed to remove any materials that may have entered the system.

4. Using a chemical feed metering pump and a chlorine tank, the chlorine solution is injected into the water system.

E. Disinfection and De-chlorination procedure (24 or 3 Hour Contact Time):

1. 24-hour Test Method:

a. Prior to disinfection, post signs on all water outlets of the system to be disinfected. Sign or tags shall read, "Water System Being Chlorinated- "Danger Do Not Drink Water" or similar warning.

b. Piping system shall then be adequately flushed with water to remove any particles and eliminate air pockets.

c. Using the continuous feed method, sodium hypochlorite conforming to ANSI/ AWWA B300 will be injected into the water system at a minimum of 50 PPM. A water flow meter provided by the water treatment technician will be used to determine the rate of injection and a chlorine test kit, Hach or equivalent, will be used to monitor the residual.

d. Chlorine residual test will be taken at all appropriate points and outlets to verify 50 PPM residual levels.

e. The chlorinated system shall be shut down for any use and the chlorinated water shall remain in the water system for retention of 24 hours.

f. After 24 hours, chlorine residual levels will again be tested at various points throughout the system to insure a minimum of 25 PPM residual. If the system has not met the minimum of a 25 PPM residual, the above disinfection process shall be repeated.

g. After satisfactory completion of the residual testing, flush out system until Hach or equivalent test reveal the water outlets have a free

chlorine residual concentration less than 0.5 PPM. The procedure shall be in accordance with the AWWA standard C651-05.

h. The OAR may allow temporary use of the water system for construction purposes pending results of the bacteriological test analysis. Sign or Tags shall be left on all outlets stating water system is not safe for consumption until laboratory results are complete and meet these specifications.

2. 3 Hour Test Method:

a. If the water systems must be turned on for use as soon as possible, a 3 hours chlorine contact time to allow for disinfection is permitted with the OAR's approval.

b. Prior to disinfection, post signs on all water outlets of the system to be disinfected. Sign or tags shall read, "Water System Being Chlorinated- "Danger Do Not Drink Water" or similar warning.

c. Piping system shall be then adequately flushed with water to remove any particles and eliminate air pockets. Using the continuous feed method, sodium hypochlorite conforming to ANSI/ AWWA B300 will be injected into the water system at a minimum of 200 PPM. A water flow meter provided by the water treatment technician will be used to determine the rate of injection and a chlorine test kit, Hach or equivalent, will be used to monitor the residual.

d. Chlorine residual test will be taken at all appropriate points and outlets to verify 200 PPM levels. The chlorinated system shall be shut down for any use and the chlorinated water shall remain in the water system for retention of 3 hours.

e. After satisfactory completion of a 3 hour disinfection period, flush out system until Hach or equivalent test reveal the water outlets have a free chlorine residual concentration less than 0.5 PPM. The procedure shall be in accordance with the AWWA standard C651-05.

f. The OAR may allow temporary use of the water system for construction purposes pending results of the bacteriological test analysis. Sign or Tags shall be left on all outlets stating water system is not safe for consumption until laboratory results are complete and meet these specifications.

F. Bacteriological Test:

1. After final flushing and satisfactory results from the residual free chlorine concentration test, Bacteriological test samples shall be collected. The intent of the following is to provide insurance for an accurate representation to a complete Bacteriological test of the water system. At least two samples shall be taken from each floor of each building.

2. Bacteriological test samples shall be delivered to a State of California Department of Health Services Certified Laboratory to perform qualitative and quantitative bacterial analyses on the water samples for the presence of any Total Coliform bacteria and Plate Count. This count must be less than 500 cfu/mL.

3. The procedure shall be repeated if it shown by bacteriological examination made by an approved agency that the level of Disinfection does not meet these specifications.

4. After satisfactory results for the bacteriological test are provided to the OAR, the physical barrier or temporary reduce pressure back flow devise shall be removed, and the new piping shall be connected to the point of connection. All the connecting piping and fittings shall be disinfected prior to installation. Chlorination Port shall be capped water tight. Warning sign or tags shall be removed.

G. Drinking Fountain and Bottle Filler Lead Test: After installation of Drinking Fountain or Bottle Filler, and successful Bacteriological Test, shut off domestic water supply line feeding the fixture, and inform OAR. OAR will coordinate with the Drinking Water Quality Program (DWQP) Supervisor in local Project Unit and M&O's Plumbing Technical Unit Supervisor to conduct lead detection test and mitigate as necessary. Do not remove related construction warning sign and tags.

3.08 VALVES ON PLUMBING SYSTEM

A. Furnish and install gates, ball, globes, angles, and check valves on plumbing Work at following locations whether indicated on drawings or not.

B. Hot and cold valves shall be:

1. Lead free complying with AB1953.

2. Above the ground copper water system, 2-inch and larger, may utilize Victaulic butterfly valves and fittings for their connections. A 2-inch or larger Victaulic valve may be in a wall if an adequately sized access panel is provided for maintenance or removal.

C. Valves shall be accessible and installed within an access panel approximately 3 feet above floor and no more than 7 feet above floor, or in a marked yard box to prevent tampering.

1. Immediately after each water meter, in addition to any valve furnished by utility company, there shall be an accessible valve on the inlet side for a strainer assembly, dual backflow device assembly and/or possibly a dual pressure reducing valve assembly.

2. A gate or ball valve on each water supply before it enters building. Valves shall be accessible from outside building and shall be installed in a marked yard box, unless otherwise indicated on drawings. Ball valves 2 ½-inch size or larger shall omit gate valve handle and furnish 2-inch square operating nut.

3. At multi story buildings, provide an isolation-valve or multiple valves for both hot and cold water in access panel to isolate and control each floor level.

4. For classrooms, shops, offices and boiler or mechanical room, install a gate or ball valve to control hot and cold water lines to each group of fixtures, a group of fixtures shall be considered to be 2 or more fixtures in the same room. When practical, valves shall be installed on the same wall as group of fixtures. Valves shall control only fixtures in rooms in which they are installed.

5. For restrooms, a gate or ball valve shall be installed in each restroom to isolate the hot and cold water supply into a restroom regardless of the number of fixtures. These valves shall control and be accessible only from within the restroom in which fixtures are installed. Valves shall be installed on the same wall as the group of fixtures it serves. Valves shall control only fixtures in restroom in which they are installed. Back to back restrooms shall be isolated separately and individually.

6. Install a gate or ball valve on each building branch line, which serves two or more fixtures, when these fixtures are not provided with a group isolation valve as specified above. These valves shall be located approximately 3 feet but not more than 7 feet above finish floor.

7. Install a gate, ball valve or partition stop for a drinking fountain or a group of drinking fountains.

8. Install a gate, ball valve or partition stop for hot and cold water supply to plumbing fixtures with no accessible supply stops, such as wall mounted faucets.

9. Install a gate, ball valve or partition stop for stops adjacent to, and controlling water flow to each sill cock and hose bib except as follows:

a. A sill cock immediately below an exterior drinking fountain may be controlled by the same gate, ball valve or partition stop as drinking fountain.

b. Valves or stops will not be required for individual hose bibs when these hose bibs are on a branch line serving only hose bibs and branch line is furnished with a shut-off valve.

10. Install a lose key angle stop, on each exposed fixture supply, and for each flush valve unless otherwise specified,

11. Install gate or ball valve at each location where a water line is connected to a piece of equipment other than items mentioned above.

12. Install a check valve on each hot water return line where it connects to a hot water storage tank or a water heater.

13. Handles, hand wheels (including dishwasher fill valve handles) and operating nuts shall be furnished of steel, brass, or cast iron and shall be removable. Unless specified to be loose key type, handles shall be securely fastened to their stems. On exposed outdoor valves, omit operating handles and provide operating nuts.

14. Provide a handle or a key for each five, or fraction thereof, loose key valves, bibs, or stops and deliver them to the project OAR.

3.09 ELECTROLYSIS PREVENTION

A. Brass nipples, 6 inches, with recognized brass unions; flanges shall be furnished and installed at locations described herein. Flanges shall be installed with complete insulating component consisting of gasket bolt sleeves and bolt washers. Dielectric insulators shall be installed at following locations:

1. Where special applications indicated on Drawings require an insulation flange or brass union, with 6-inch brass nipple to be installed in a condensate line, or steam line, flange insulation shall be of a high temperature type, suitable for continuous operation at temperatures up to 220 degrees F. for condensate and 400 degrees F. for steam.

2. Where steel or cast iron in ground connects to copper or brass piping above ground, transition from steel or cast iron pipe to copper or brass pipe shall be provided in an accessible location.

3. Underground dielectric connections shall be furnished in accessible yard boxes.

4. Above ground dielectric connections shall be exposed; or if in finished rooms shall be located in accessible access boxes.

3.10 UNDERGROUND PIPE MARKERS

A. Pipe markers shall be furnished according to Section 22 0553: "Plumbing Identification"

B. Underground Caution Tape shall be placed 12 to 18 inches above the utility line. The Caution Tape shall be a designated color and marked with the appropriate name for the specific type of utility pipe as follows:

1. Yellow – with the words: CAUTION GAS LINE BELOW

2. Blue – with the words: CAUTION WATER LINE BELOW

3.11 DEPTH OF SEWER LINES

A. Minimum depth of below grade sewer lines shall be 24 inches to centerline of pipe. Sewer lines shall slope ¼ inch per foot minimum, unless otherwise indicated. Minimum depth at Owner property line shall be 6 feet, unless otherwise required.

3.12 BACKFLOW PREVENTION DEVICES

A. Backflow Devices: Installation of backflow devices shall be tested and certified by Los Angeles County backflow device tester before Substantial Completion. Tests shall be performed in presence of Project Inspector. Test reports shall be turned over to Project Inspector for mailing to proper agency.

3.13 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose off Project site.

3.14 PROTECTION

A. Protect Work of this section until Substantial Completion.

END OF SECTION

SECTION 23 0500

COMMON WORK RESULTS FOR HVAC

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. This Section provides the basic mechanical requirements that apply to the Work of Division 23.

B. Related Requirements:

1. Division 01: General Requirements.

2. Division 26: Electrical.

1.02 REGULATORY REQUIREMENTS

A. Materials, fabrication, equipment, and installation shall comply with industry standards and code requirements. Where manufacturer's recommendations exceed industry standards, the manufacturer's recommendation shall establish the minimum standard. As a minimum, standards from the following organizations shall apply:

1. AMCA - Air Movement and Control Association.

2. ANSI - American National Standards Institute.

3. ASME - American Society of Mechanical Engineers.

a. ASME Boiler and Pressure Vessel Code.

b. ASME B31 - Code for Pressure Piping.

4. AHRI - Air-Conditioning, Heating, and Refrigeration Institute.

5. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers.

6. ASTM - American Society for Testing and Materials.

a. ASTM A53 - Specification for Welded and Seamless Pipe.

7. CSA - Canadian Standards Association.

8. FM Global - Factory Mutual Global

9. IAPMO - International Association of Plumbing and Mechanical Officials.

10. NFPA - National Fire Protection Association.

11. OSHA - Occupational Safety and Health Administration.

12. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association.

13. UL - Underwriters Laboratories Inc.

14. Intertek (ETL Certification).

B. Materials, fabrication, equipment, and installation shall comply with federal, state, and local codes including, but not limited to, the following:

1. CBC, California Building Code, and CMC, California Mechanical Code.

a. Latest edition as adopted by the County of Los Angeles, and the State of California including amendments effective on the Effective Date of the Contract.

2. California Code of Regulations, Title 8, Industrial Relations, Division 1, Chapter 4, Division of Industrial Safety.

3. OSHA - Occupational Safety and Health Administration.

4. CDPH – California Department of Public Health.

5. SCAQMD - South Coast Air Quality Management District.

C. Specifications or Drawings shall not be construed to permit deviation from the requirements of governing codes unless approval has been obtained from legally constituted authorities having jurisdiction, and the Architect. The Contract Documents may contain more stringent requirements than those legally required.

D. Permits and Fees: Refer to the General and Supplementary Conditions.

1.03 SUBMITTALS

A. Provide submittals in accordance with Section 01 3300: Submittal Procedures and with specific requirements of Division 23 sections, as applicable.

B. After Architect's approval, the above information shall become the basis for inspecting and testing materials and actual installation procedures performed in the Work.

C. Shop Drawings: Submit one additional copy when control diagrams having line voltage connections are indicated. Shop Drawings shall be specifically prepared for the Work of this Project. Drawings prepared in accordance with requirements of Section 01 3113: Project Coordination and Section 01 3300 may be provided by the Architect to serve as a background for the Shop Drawings. Shop Drawings shall comply with the requirements of Section 01 3113 and Section 01 3300 and shall indicate at a minimum:

1. Complete system layout of equipment, components, ductwork, and piping, indicating 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 / support locations. All the above items shall be coordinated on the shop drawings according to the requirements of Section 01 3113.

2. Schedule and description of equipment, ductwork, piping, fittings, valves, dampers, and controllers.

1.04 PROJECT RECORD DOCUMENTS

A. Comply with provisions of Section 01 7700: Contract Closeout.

B. Project Record Drawings:

1. Provide a complete set of mechanical and control system drawings in AutoCAD and, if available, BIM, complete with external reference drawings, fonts, blocks and plotter pen color/line thickness settings on CD-ROM. Also submit one set of full size reproducible plots on vellum and three sets of prints.

2. Before Contract Completion, deliver corrected and completed prints to the OAR. Delivery of project record documents to the OAR does not relinquish responsibility of furnishing required information omitted from project record documents.

C. Operation and Maintenance Manuals:

1. Submit operation and maintenance manuals in required form and content. If no revisions are required, furnish one additional copy. If revisions are required, one copy shall be returned with instructions for changes; perform such changes and return manuals. Manuals shall be bound in accordance to Section 01 7700. Deliver manuals to the OAR. Submit an electronic copy of the entire manual in PDF file format.

2. Contents of Manual:

a. Title sheet with Project name, including names, addresses and telephone number of Contractor, installer, and related equipment suppliers.

b. Manufacturer's operating instructions including, but not limited to, the following:

1) Identification of components and controls.

2) Pre-start checklist and start-up procedures.

3) Normal operation settings and checklists.

4) Pre-shut down checklist and shut down procedures.

5) Trouble shooting checklist and guidelines.

6) Recommendations for optimum performance.

7) Warnings and safety precautions on improper or hazardous operational procedures or conditions

c. Manufacturer's product data and parts and maintenance booklet for each item of equipment furnished under Division 23 that includes the following as a minimum:

1) Manufacturer’s model, identification and serial numbers.

2) Exploded view of assembly drawings identifying each component or part with the relevant part number.

3) Directory of manufacturer’s representatives, service contractors and part distributors.

4) Maintenance and trouble-shooting instructions, including schedule for preventive maintenance, periodic inspection and cleaning criteria.

d. Project Record Drawings: Complete set of mechanical and control system drawings in 50 percent reduced print format shall be furnished with the manual. Submit the above record drawings on CD-ROM in AutoCAD and, if available, BIM, complete with external reference drawings, fonts, blocks, and plotter pen color/line thickness settings.

e. Testing, Adjusting, and Balancing reports: Submit as specified in Section 01 4525.

f. South Coast Air Quality Management District (SCAQMD) permits to install and operate boilers, water heaters and other fuel burning equipment and third-party source test reports as required by SCAQMD to allow start-up and operation of equipment.

g. Los Angeles County industrial waste permits.

h. Valve directory complete with location, function, size, and model of each valve with reference to the project record drawings.

i. Equipment and component identification chart complete with location, function, size, and model of each equipment or component with reference to the project record drawings.

1.05 COORDINATION

A. Contract Documents indicate extent and general arrangement of Work under Division 23. Contractor shall coordinate work in accordance with Section 01 3113 requirements and make adjustments as required to provide maximum headroom, a neat arrangement to keep passageways and openings clear to provide accessibility and provisions for maintenance, and to meet code requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage: Deliver materials to Project site in their original unopened containers with labels intact and legible at time of delivery. Store in strict accordance with manufacturer's recommendations.

B. Do not store plastic pipe or materials in direct sunlight.

1.07 PRELIMINARY OPERATION

A. OAR may require any portion of mechanical Work to be operated before Substantial Completion. Such operation shall be in addition to regular tests, demonstrations and instructions required under the Contract Documents, and shall be performed as required.

B. Notify the Project Inspector at least 24 hours in advance of lighting or re-lighting pilots.

1.08 TRAINING OF OWNER PERSONNEL

A. Training of Owner’s personnel shall include:

1. A minimum of 8 hours of on-site overview of the overall Mechanical System.

2. Refer to Division 23 sections for specific training on each of the components of the Mechanical System.

3. A minimum of 8 hours of on-site overview identifying location and function of all Control Valves and Actuator assemblies.

4. A minimum of 40 hours of (in classroom) software training for a minimum of 20 LAUSD personnel on EMS/BMS if such systems are utilized in the project. Training shall be conducted at control contractor training facility with computer setup for each person attending.

B. Contract shall include the cost of training Owner operation and maintenance personnel in operating, adjusting, maintenance, trouble-shooting, and Project site repair of each component, equipment, or system provided under this Contract.

C. Operational and maintenance training shall be conducted on the Project site, unless indicated otherwise.

D. Upon completion of Owner training, a completion certificate indicating the nature of the training and a description of the systems, complete with equipment and component lists shall be issued to each trainee. The certificate should be issued in duplicate with one copy retained by OAR.

E. An attendance sheet with the names and signatures of all participants attending the training shall be submitted to the OAR and kept as part of the project documents.

1.09 GUARANTEES AND DAMAGE RESPONSIBILITY

A. Sound of water flowing in piping shall not be transmitted to building structure. Operation of mechanical system shall not produce operational sounds that can be heard outside of rooms enclosing apparatus or equipment.

PART 2 – PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Unless otherwise specified, materials and equipment shall be new, in good and clean condition. Equipment, materials, and components shall be of the make; type and model number noted on Drawings or specified. Pieces of equipment of the same type shall be by the same manufacturer.

B. Whenever an item is listed by a single proprietary name, with or without model number and type, it shall be for purpose of design only, to indicate characteristics and quality desired. Proprietary designation listed on Drawings, or listed first in Specifications, is used as a basis for design to establish a standard for quality and performance and space requirements.

C. HVAC equipment products from different manufacturers are never identical. Equipment approved as being equal is interpreted as being equivalent in capacity, performance and quality. The dimensions, weight, configuration and utility requirements could be quite different from the equipment used as the basis of design. Due to these differences, additional coordination and adjustments by the Contractor are required. For the equipment to be deemed truly equal, the additional coordination and adjustments by the Contractor should not incur any additional cost to the Owner and any additional labor to the design team.

D. Equipment and materials indicated or required to be installed outdoors shall be of the type that is designed, manufactured, listed or approved by authorities having jurisdiction for outdoor installation by being resistant to the adverse effects of weather. All the additional protective measures against outdoor weather required by the manufacturers' installation instructions and prevalent practice shall be provided.

E. For substitution of materials or products, refer to the General Conditions.

PART 3 – EXECUTION

3.01 SERVICE INTERRUPTIONS, OFF-SITE, GAS AND WATER

A. Schedule Work so there shall be no service interruptions of existing systems or systems during normal hours of operation of affected systems and facilities.

B. When service interruptions are mandatory, arrange in advance with the OAR as to time and date of such interruptions.

C. Systems, which are interrupted, shall be returned back into operation in such manner that they will function as originally intended.

3.02 CUTTING, NOTCHING, AND BACKING

A. Conform to California Building Code, Title 24, Part 2, for notches and bored holes in wood and for pipes and sleeves embedded in concrete and for cuts in steel, as detailed on structural Drawings.

B. Where pipes or ducts pass through, or are located within one inch of any construction element, install a resilient pad, 1/2 inch thick minimum, to prevent contact.

C. Furnish all necessary provisions for recesses, chases, and accesses and provide blocking and backing as necessary for proper reception and installation of mechanical Work.

3.03 LOCATION OF PIPING AND EQUIPMENT

A. Location of piping, apparatus and equipment as indicated on Drawings is approximate and shall be altered to avoid obstructions, preserve headroom, and provide free and clear openings and passageways.

B. Trenches parallel to footings shall not be closer than 18 inches to the face of footings and shall not be below a plane having a downward slope of 2 horizontal to one vertical, from a line 9 inches above bottom of footing.

C. Pipe in tunnels shall be installed close to one side of tunnel to provide maximum space for passage. Pipe shall not be installed through crawl hole unless otherwise specified or detailed on Drawings.

D. Place equipment in locations and spaces indicated, disassemble and/or reassemble equipment as required by Project conditions.

3.04 TESTS AND TESTING

A. Tests shall be as required under the applicable sections of Division 23, including this Section.

B. Tests required by other sections of the Contract Documents include the following:

1. Test and balance of mechanical equipment and systems: Refer to Section 01 4525: Testing, Adjusting, and Balancing for HVAC.
2. Hydrostatic test of boilers: Refer to Section 01 4525: Testing, Adjusting, and Balancing.
3. Test of smoke and fire detectors: Refer to Division 26: Electrical.

C. Additional tests may be required in the case of products, materials, and equipment if:
1. Submitted items are altered, changed, or cannot be determined as exactly conforming to the Contract Documents.
2. Performance testing and results may also be required on certain items which are as specified, including fan, and pump performance.

D. Piping Tests:
1. Perform tests required to demonstrate that operation of mechanical systems and their parts are in accordance with Specifications covering each item or system, and furnish materials, instruments and equipment necessary to conduct such tests. Tests shall be performed in presence of the Project Inspector, and representatives of any governmental agency having jurisdiction. Work shall not be concealed or covered until required results are provided.
2. If required tests are not performed, Owner may provide in accordance with the Contract Documents.
3. Pressure gages furnished in testing shall comply with CPC. Air shall be bled from lines requiring hydrostatic or water tests.
4. Systems shall be pressure-tested in accordance with pipe testing schedule below. Pipe test shall indicate no loss in pressure after a minimum duration of 4 hours at test pressures indicated. Where local codes require higher test pressures than specified herein for fire sprinkler systems, local codes shall govern.
5. Fuel gas lines shall be first tested with piping exposed, before backfilling trenches or lathing; second with piping in finished arrangement, backfilled and paved where required, and walls finished.
6. Refrigerant piping may be tested with a halide detector or calibrated electronic testing equipment.
7. Piping systems may be tested as a unit or in sections, but entire system shall successfully meet requirements specified herein, before final testing by the Project Inspector.
8. Repair of damage to pipes and their appurtenances or to any other structures resulting from or caused by these tests, shall be provided.

E. Pipe Testing Schedule:

System Tested	Test Pressure (psig)	Test With:

Steam piping, hot water heating system piping and chilled water piping	150	Water
Vacuum pump or condensate pump discharge and condensate return piping	150	Water
Refrigeration piping		
R-22	400	Dry nitrogen
R-134a	300	Dry nitrogen
R-401a	300	Dry nitrogen
R-401b	300	Dry nitrogen
R-404a	500	Dry nitrogen
R-407c	500	Dry nitrogen
R-410a	600	Dry nitrogen
R-507	500	Dry nitrogen
Radiant panel piping	150	Water

F. Equipment Performance Assurance Tests:

1. Before operating any equipment or systems, a thorough check shall be performed to determine that systems have been flushed and cleaned as required and that equipment has been properly installed, aligned, lubricated, and serviced. Factory instructions shall be checked to verify installations have been completed and recommended lubricants have been installed in bearings, gearboxes, crankcases, and similar equipment. Particular care shall be furnished in lubricating bearings to avoid damage by over-lubrication and blowing out seals. Equipment shall also be checked for damage that may have occurred during shipment, after delivery, or during installation. Damaged equipment, products, and materials shall be replaced or repaired as required.

2. Upon completion of the above, adjust the system settings to within normal operating conditions to prevent the system from being damaged upon start-up.

3. Run-test the equipment after start-up for five consecutive days. Tests shall include operation of heating, ventilating, and air conditioning equipment and systems for a period of not less than two 8 hour periods at 90 percent of the full specified heating and cooling capacities. If equipment passes, install new filters. If equipment fails, it shall be adjusted and retested until system meets all applicable codes.

4. Equipment Start-up Reports: For each equipment or system on which start-up is performed, submit 8 copies of start-up report for review by the Architect.

a. The start-up report shall include the manufacturer's standard start-up form completed and signed by the start-up technician.

5. Provide, maintain, and pay costs for equipment, instruments, and operating personnel as required for specified tests.

6. Provide electric energy and fuel required for tests.

7. Final adjustment to equipment or systems shall meet specified performance requirements.

8. Equipment, systems, or Work deemed defective during testing shall be replaced or corrected as required. Test until satisfactory results are provided.

G. Specific Coordinated Plan for Test and Balance:

1. Provide a narrative of the operational intent that clearly describes the function and sequence of operation of each component, equipment, or system installed. Instruct designated Owner personnel in the operation of the installed systems.

2. Prior to final test and balance, mechanical equipment and systems shall be operated and tested as indicated in Paragraph 3.04.F above to demonstrate satisfactory overall operation of the installed systems.

3. Immediately before starting tests, air filter media shall be cleaned or renewed. Roll-type filters shall be advanced to provide new clean media. Cleanable type media shall be thoroughly cleaned and re-oiled with new, clean oil as recommended by manufacturer if they are of viscous impingement type. Disposable type filters shall be replaced with new filters. Replaceable media shall be replaced with new media.

4. An accurate means of measuring air flow and temperatures shall be furnished to balance air supply, return, and exhaust systems so uniform temperatures occur in every room and design airflow is obtained through registers, diffusers, and grilles.

5. Systems shall be adjusted to provide airflows indicated including maximum fresh air and maximum return air. Dampers shall be checked for proper settings and operation. Air and water inlet and leaving temperatures at coils shall be checked. Complete operational data including airflows, room temperatures, fan speeds, motor currents, plenum, and duct static pressures shall be tabulated.

6. Welding performed as part of this Division may be subject to radiographic inspections at random in accordance with requirements specified in Section 23 0513: Basic HVAC Materials and Methods.

3.05 NOISE AND VIBRATION REDUCTION

A. Correct noise or vibration caused by mechanical systems. Provide all necessary adjustments to specified and installed equipment and accessories to reduce noise to the lowest possible level

B. Correct noise or vibration problems caused by failure to install work in accordance with Contract Documents. Include all labor and materials required as a result of such failure.

Pay for re-testing of corrected noise or vibration problems by the project acoustical consultant including travel, lodging, test equipment expenses, etc.

3.06 PROTECTION, CARE AND CLEANING

A. In addition to storage criteria of the General Conditions, and provisions under Section 01 5000: Construction Facilities and Temporary Controls, the following shall be provided:

1. Provide for the safety and good condition of materials and equipment until Substantial Completion. Protect materials and equipment from damage.

2. Protect installed Work.

3. Replacements: In case of damage, immediately provide repairs and/or replacements as required.

4. Protect covering for bearings, open connections to tanks, pipe coils, pumps, compressors and similar equipment.

5. Interior of ductwork shall be maintained free of dirt, grit, dust, loose insulation, and other foreign materials.

6. Air handling equipment shall not be operated until building is cleaned and air filters are installed.

7. Fixtures, piping, finished brass or bronze, and equipment shall have grease, adhesive, labels, and foreign materials removed. Chromium, nickel plate, polished bronze or brass Work shall be polished. Glass shall be cleaned inside and out.

8. Before initial start-up and again before Substantial Completion, piping shall be drained and flushed to completely remove grease and foreign matter. Pressure regulating assemblies, traps, strainers, boilers, flush valves, and similar items shall be thoroughly cleaned. Tag system with an information tag listing responsible party and date of element, before initial start-up and again before Substantial Completion. Compressed air, oil, and gas piping shall be blown out with oil-free compressed air or inert gas. Refrigerant piping shall be cleaned as specified.

END OF SECTION

SECTION 23 0553

HVAC IDENTIFICATION

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Marking and identification required on mechanical piping systems, ducts, controls, valves, apparatus, etcetera.

B. Related Requirements:

1. Division 01: General Requirements.

2. Section 23 3000: Air Distribution.

1.02 SUBMITTALS

A. Submit in accordance with Division 01 and Section 23 0500: Common Work Results for HVAC.

B. Submit product data and installation instructions for each item specified.

C. Submit Samples of materials.

1.03 QUALITY ASSURANCE

A. Comply with provisions of:

1. Section 23 0500: Common Work Results for HVAC.

2. ANSI/ASME A13.1: Scheme for the Identification of Piping Systems.

3. APWA: Uniform Color Code.

Or

4. IAPMO: Uniform Plumbing Code (UPC).

PART 2 – PRODUCTS

2.01 MATERIALS

A. General: Piping systems, controls, valves, apparatus, etc., except those that are installed in inaccessible locations in partitions, walls, and floors, shall be permanently identified.

2.02 VALVES

A. Furnish prepared chart or diagram for each piping system, indicating by identifying letter or model number of each valve in the system, its location, and function.

B. Install charts in aluminum frame with clear glass front and secure on wall where designated by the Project Inspector.

C. Bind copies of each chart in operating instructions manual.

D. Provide each valve with a brass, aluminum, or plastic disc, not less than 1-1/4 inches diameter bearing engraved numbers corresponding to those indicated on chart. Fasten discs to valve with No. 14 brass wire.

E. Provide an additional tag for safety valves and other valves that could be hazardous to safety and health of occupants. Distinguish these tags from regular valve tags by color (such as yellow with black letters, and marked "Danger"); submit Sample tag to the Architect for review.

2.03 INSTRUMENTS AND CONTROLS

A. Identify panel-mounted instruments and controls with engraved bakelite nameplates permanently affixed to panel boards.

B. Identify alarm indicating devices and alarm reset devices by nameplates.

C. Identify damper motors and automatic valves, flow switches, pressure switches, etc., with embossed aluminum or plastic tape affixed to controller, indicating service and setting.

2.04 EQUIPMENT

A. Identify each major piece of equipment with engraved bakelite nameplates permanently affixed to the equipment, indicating the room numbers it services, Equipment identification designation shall be the same to its designation indicated on the “As-Built Drawings”. Room numbers in the nameplates shall correspond to the final room numbers.

2.05 ABOVE GRADE PIPE IDENTIFICATION

A. Identify pipes by means of colored labels with directional flow arrows and identification of the pipe content, in conformance to ANSI/ASME A13.1 or the UPC.

B. Materials: Precoiled acrylic plastic with clear polyester coating, all-temperature, self-adhering, as manufactured by Brady, Brimar Industries, Seton, Stranco, Inc., or equal.

C. Size:

Outside Diameter of Pipe or Insulation	Length of Color Field	Size of Letter
¾ to 1 ¼-inch	8-inch	½-inch
1 ½ to 2-inch	8-inch	¾-inch
2 ½ to 6-inch	12-inch	1 ¼-inch”
8 to 10-inch	24-inch	2 ½-inch”
over 10-inch	32-inch	3 ½-inch

D. Colors: As indicated in schedule.

E. Locations:

1. On accessible piping, whether insulated or not (including mechanical rooms, attic and ceiling spaces); except that labels shall be omitted from piping where contained material is obvious due to its connection to fixtures (such as faucets, water closets, etc.).

2. Near each valve and branch connection in such accessible piping.

3. At each pipe passage through wall or floor.

4. At not more than 20 feet spacing on straight pipe run between bands required in 2 and 3 above.

5. At each change in direction.

F. Application: Install on clean surfaces free of dust, grease, oil, or any material that will prevent proper adhesion. Replace non-adhering or curling labels with new labels, as required by the Project Inspector.

G. Schedule:

Content of Pipe	Legend	Background Color	Lettering Color
Steam	Steam	Yellow	Black
Steam condensate	Stm. Cond.	Yellow	Black
Chilled water supply	Chill water supply	Green	White
Chilled water return	Chill water return	Green	White
Instrument air	Inst. Air	Green	White
Heating hot water	Heating hot	Yellow	Black

supply	water supply		
Heating hot water return	Heating hot water return	Yellow	Black
Air conditioning condensation drain	A/C condensate drain	Green	White

2.06 UNDERGROUND PIPE

A. Detectable Marking Tape:

1. Provide and install detectable marking tape along buried piping. Tape shall be specifically manufactured for marking and locating underground utilities with electronic equipment. Tape shall be acid and alkali resistant, and manufactured with integral wires or foil backing, encased with protective cladding. Tape shall be a minimum of two inches in width.

2. Manufacturer: Reef Industries, Inc., Advantage Brands, Inc., Northtown Company, Mutual Industries, Inc., or equal.

3. Detectable marking tape shall be color-coded per APWA Color Code:

a. Yellow: Steam.

b. Blue: Water.

c. Red: Electric power lines, cables, conduit and lighting cables. By Division 26.

d. Orange: Communication, alarm or signal cables. By Divisions 26 and 27.

B. Tracer Wire:

1. Solid copper wire type THWN, 12 AWG gage, with heat and moisture resistant insulation.

2.07 IDENTIFICATION OF AIR CONDITIONING EQUIPMENT

A. Provide identification markers to locate air conditioning equipment above T-bar ceilings. Install 3/4 inch to one inch diameter colored self-adhesive dots to T-bar ceiling grid indicating point of access. The following identification markers shall be recorded on the project record documents:

1. Fire Damper and Combination Fire/Smoke Fire Damper: Red.

2. Manual Volume Dampers, Relief Dampers, Motorized Volume Dampers: Blue.

a. Supply air: Full dot.

b. Return air: Half dot.

3. Fan coil unit: Green.

4. Filter Location if separate from fan coil: Yellow.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Correct detrimental conditions prior to commencing the Work of this Section. Install markers and identification tags as specified with materials and installation procedures recommended by manufacturer.

B. Place tracer wire on top of non-metal utility lines allowing some slack. Do not wrap tracer wire around pipe. Fasten tracer wire in place at approximately 10 feet on centers with non-metal ties.

C. Install underground detectable pipe marking tape continuously buried 8 to 10 inches above the buried utility pipe. Wrap tape on pipe risers up to a height of 12 inches above grade.

3.02 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 23 0700

HVAC INSULATION

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Condensate drain piping from air conditioning equipment.

2. Vacuum and condensate pump discharge lines over 50 feet in length.

3. High and low temperature equipment.

4. Heating hot water supply and return piping.

5. Chilled water supply and return piping.

6. Refrigerant piping.

7. Supply and return air ducts for heating and cooling systems air ducts.

B. Related Requirements:

1. Division 01: General Requirements.

2. Section 23 0500: Common Work Results for HVAC.

3. Section 23 0553: Mechanical Identification.

4. Section 23 3000: Air Distribution.

1.02 REFERENCES

A. American Society for Testing and Materials International (ASTM):

1. ASTM C167 - Standard Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations.

2. ASTM C209 - Standard Test Methods for Cellulosic Fiber Insulating Board.

3. ASTM C302 - Standard Test Method for Density and Dimensions of Preformed Pipe-Covering-Type Thermal Insulation.

4. ASTM C411 - Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

5. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

6. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

7. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

8. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.

9. ASTM D5116 - Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.

10. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

11. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

12. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

13. ASTM G22 - Standard Practice for Determining Resistance of Plastics to Bacteria.

B. Underwriters Laboratories Inc.:

1. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors.

2. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

C. National Fire Protection Association:

1. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems .

2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

3. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

A. Submit in accordance with Division 01 and Section 23 0500: Common Work Results for HVAC.

1. Complete material list of items to be furnished and installed under this Section.

2. Manufacturer's specifications and other data required demonstrating compliance with the specified requirements.

3. Shop Drawings, catalog cuts and manufacturer's data indicating insulation, jacketing, adhesives, and coating. Insulating materials shall be certified by manufacturer to comply with the California quality standards for insulating materials.

4. Display sample cutaway sections.

5. Manufacturer's recommended method of installation procedures, which will become part of this Section.

1.04 QUALITY ASSURANCE

A. Qualifications of Manufacturer and Installer, Materials, Fabrication, Execution, and Standard of Quality: Comply with provisions stated under Section 23 0500: Common Work Results for HVAC and Section 23 0513: Basic HVAC Materials and Methods.

B. Test Ratings:

1. Comply with provisions stated under Section 23 0500 and 23 0513 with emphasis on ASTM E84, NFPA 255, or UL 723. ASTM C167, ASTM C302, UL label or listing of satisfactory test results from the National Institute of Standards and Technology, or a satisfactory certified test report from an acceptable testing laboratory. Approval by the State Fire Marshal is required.

2. Furnish labels, legibly printed with the name of the manufacturer or listings indicate that fire hazard ratings do not exceed those specified for materials proposed for installation. Flame spread index of not more than 25 and smoke developed rating not exceeding 50.

3. Tests shall be performed on each item individually when insulation, vapor barrier covering, wrapping materials, or adhesives are installed separately at the Project site.

4. Test insulation, vapor barrier covering, wrapping materials and adhesives as an assembly when they are factory composite systems.

C. Regulatory Requirements: Insulation furnished and installed under this Section shall conform to the requirements of the California Building Code Parts 4, Mechanical Code, Part 5, Plumbing Code and Part 6, Energy Code.

D. All chemically based products such as sealers, primers, fillers, adhesives, etc. shall meet the California air quality regulations.

1.05 PRODUCT HANDLING

A. Protection, Replacement, Delivery and Storage: Comply with provisions stated under Sections 23 0500: Common Work Results for HVAC and 23 0513: Basic HVAC Materials and Methods.

PART 2 – PRODUCTS

2.01 DUCTWORK AND PLENUM INSULATION

A. General: Insulate ductwork and plenums with not less than the amount of insulation tabulated in Table 4, unless noted otherwise on the drawings. Insulation may be omitted under the following conditions:

1. Exposed return air ductwork in conditioned space.

2. Return air ductwork between wall studs inside an interior wall.

TABLE 4 - INSULATION OF DUCTS AND PLENUM

Duct Location	Insulation Type
Exposed interior round and oval supply air ductwork located at Gyms and MPR Stages	DW-1
Exposed interior rectangular supply air ductwork located at Gyms and MPR Stages	L-1
Exterior locations of Health Units and Clinics	DW-2
Exterior locations other than Health Units and Clinics	L-2
In walls, within floor/ ceiling spaces	F-1 or L-1 See note 3
Hot and cold plenums	F-2, DW-1 or L-2 See note 3
Attics, Garages, and Crawl Spaces, within unconditioned space or in basement	F-3 or L-2 See note 3

B. Insulation Types:

1. DW-1: 1-inch thick insulation sandwiched inside double-wall type ducts and fittings.

2. DW-2: 2-inch thick insulation sandwiched inside double-wall type ducts and fittings. Duct joints shall be waterproofed.

3. F-1: 1½-inch blanket fiberglass, factory-laminated with all-service jacket vapor barrier.

4. F-2: 2-inch blanket fiberglass, factory-laminated with all-service jacket vapor barrier.

5. F-3: 3-inch blanket fiberglass, factory-laminated with all-service jacket vapor barrier.

6. L-1: 1½-inch Internal duct lining.

7. L-2: 2-inch Internal duct lining.

C. Notes:

1. Minimum insulation provided shall be as required by the current California Mechanical Code Title 24 for the most restrictive condition.

2. Refer to the materials indicated in this section for external insulation & Internal Lining.

3. External insulation shall be replaced with internal duct lining (of equivalent thermal resistance value unless noted otherwise) where indicated on the drawings or specified elsewhere for sound attenuation.

4. Provide internal duct lining (1 ½-inch unless noted otherwise) where indicated on the drawings or specified elsewhere for sound attenuation.

5. All exterior insulated ductworks shall be water proofed at joints, seams and duct penetrations.

D. Materials:

1. Fire-Resistive Insulation Materials and Coatings: Submit State Fire Marshal pre-approved materials only.

2. Adhesives: See Paragraph 2.01.E for applicable products.

3. External Insulation: Provide glass fiber blankets that are factory-laminated with Foil Reinforced Kraft (FRK) vapor barrier facing; Johns Manville Microlite, Owens-Corning SOFTR Duct Wrap, Knauf Insulation Friendly

Feel Duct Wrap, or equal. Provide a minimum installed R value as required by the CEC Building Energy Efficiency Standards; but not less than scheduled on Table 5:

TABLE 5
INSULATION OF DUCTS AND PLENUM INSTALLED
THERMAL RESISTANCE "R" VALUES

Type	Labeled Thickness (in inches)	Installed R Value ($hr.ft^2.°F/Btu$)
F-1	1 ½	4.2
F-2	2	5.6
F-3	3	8.3
DW-1	1	4.2
DW-2	2	5.6
L1	1 ½	6.0
L2	2	8.0

4. Internal Lining: Internal Lining shall be of the type that inhibits the growth of mold, mildew and fungi and shall not contain harmful VOC's or contain glass fiber. Approved Material:

   a. Polyester Duct Liner:

      1) Polyester duct liner shall be an engineered nonwoven, thermally bonded Polyester with a smooth and durable FSK facing.

      2) Polyester duct liner must be able to withstand a constant internal temperature up to 250°F must be compliant with Greenguard Environmental Institute and contain zero VOCs per ASTM D5116. Liner must comply with all applicable standards including ASTM E84, ASTM C411, ASTM C518, ASTM G21, NFPA 90A and 90B, and UL 181.

      3) Approved Manufacturer: Ductmate Industries "PolyArmor" duct liner or approved equal.

   b. Elastomeric duct liner:

      1) Closed-cell, sponge- or expanded-rubber materials. Elastomeric liner must be able to withstand a constant internal temperature up to 300°F and must comply with all applicable standards including ASTM E84, ASTM E96, ASTM C209, ASTM C534 - Type II sheet materials,

ASTM C411, ASTM C518, ASTM G21, ASTM G22, NFPA 90A and 90B, and UL 181.

2) Approved Manufacturer: Armacell LLC "AP Armaflex FS" duct liner or approved equal.

c. Duct liner must be attached per manufacturer's requirements using a non-flammable, low VOC water-based adhesive. When applicable, apply a non-flammable, low VOC water-based lagging adhesive to the exposed leading edge of the insulation. Install fasteners per SMACNA HVAC Duct Liner installation instructions.

d. Duct liner must be installed per SMACNA Manual, "HVAC Duct Construction Standards, Metal and Flexible," Third Edition unless otherwise specified.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Except as specified herein, install material in accordance with recommendations of manufacturer. Do not install insulation materials until tests specified in other sections are completed. Remove foreign material such as rust, scale, or dirt. Surfaces shall be clean and dry. Maintain insulation clean and dry at all times.

B. On cold surfaces where a vapor barrier must be provided and maintained, insulation shall be installed with a continuous, unbroken moisture and vapor seal. Hangers, supports, anchors, or other projections that are fastened to cold surfaces shall be insulated and vapor sealed to prevent condensation.

C. Surface finishes shall be extended in such a manner as to protect raw edges, ends, and surfaces of insulation.

D. Pipe or duct insulation shall be continuous through walls, ceiling or floor openings, or sleeves; except where fire-stop or fire-safing materials are required.

E. Metal shields shall be installed between hangers or supports and the piping insulation. Rigid insulation inserts shall be installed between the pipe and the insulation shields. Inserts shall be of equal thickness to adjacent insulation and shall be vapor sealed accordingly.

F. Insulation shall not be installed in the following locations unless otherwise noted:

1. On vacuum return lines less than 50 feet long.

2. On unions, flanged connections or valve handles.

3. Over edges of any manhole, clean-out hole, clean-out plug, access door or opening to a fire damper, so as to restrict opening or identification of access.

4. Over any label or stamp indicating make, approval, rating, inspection, or similar data, unless provision is made for identification and access to label or stamp.

3.02 INSTALLATION OF DUCTWORK AND PLENUM INSULATION

A. External Covering:

1. Before installing duct insulation, sheet metal ducts shall be clean, dry, and tightly sealed at joints and seams, inspected pressure tested, and accepted by LAUSD OAR/ Inspector.

2. Duct exterior insulation shall be firmly wrapped around ductwork with joints lapped a minimum of 2-inch. Insulation shall be securely fastened with 18 gage copper-lined steel wire, or 16 gage soft-annealed galvanized wire spaced approximately 12-inch on centers and at loose ends, presenting a neat and workmanlike appearance. Where duct width is such that wiring will not fasten insulation firmly against duct an adhesive shall be furnished to fasten insulation to duct with wiring being installed at ends of insulation segment.

3. Insulation on ductwork transporting conditioned air, both supply and return, and outside air intake ducts when pre-conditioned, shall be furnished with a factory-applied, fire-resistant vapor barrier.

4. Exposed Ducts or Plenum:

a. Install insulation to ducts or plenum furnished with butt joints, without voids and with adhesive over entire surface of duct. Cover insulation with canvas jacket, fastened tightly to insulation with lagging adhesive. Install 2 finish coats of undiluted adhesive.

b. When installing jacket, finished covering shall be even and level, without humps, with constant diameters on round ducts maintained.

B. Interior insulation - lining:

1. Dimensions of ducts indicated are net inside dimensions and must include thickness of duct liners to obtain the required duct size.

2. Install insulation in square turns, where required, to cover interior surfaces before duct turns are installed.

3. Install lining material during fabrication of duct with sealed face only exposed to air stream.

4. Interior insulation in ducts or plenums shall not have exposed edges. Edges open to entering or leaving air streams shall be covered, secured in place and sealed with approved duct liner edge sealers.

5. Insulation shall be fastened to sheet metal with an approved fire-retardant adhesive, with minimum 90 percent coverage and edges firmly adhered.

6. Mechanical fasteners shall supplement the adhesive on top sections of ducts more than 12-inch wide and on sides of ducts more than 24-inch high and shall be spaced on 16-inch centers maximum. Fastener posts shall be cut off approximately ¼-inch from metal disc.

3.03 CLEANUP

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 23 0800

HVAC SYSTEMS COMMISSIONING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. General requirements for Commissioning (Cx) of HVAC systems and equipment including installation, start-up, testing, documentation, and training according to the Construction Documents.

2. Standard procedures for the execution of commissioning work shall be in conformance with Division 01, Section 01 9113: General Commissioning Requirements. Coordinate work with the Commissioning Services Provider (CxSP).

B. Related Requirements:

1. Division 01: General Requirements.

2. Section 01 4523: Testing and Inspection.

3. Section 01 4525: Testing, Adjusting, and Balancing for HVAC.

4. Section 01 7900: Maintenance and Operations Staff Demonstration and Training.

5. Section 01 9113: General Commissioning Requirements.

6. Section 23 0500: Common Work Results for HVAC.

7. Section 23 3000: Air Distribution.

8. Section 26 0500: Common Work Results for Electrical.

9. Section 26 0513: Basic Electrical Materials and Methods.

10. Section 28 3149: Carbon Monoxide Detection and Alarm Systems.

11. Section 26 0800: Electrical Systems Commissioning.

1.02 REFERENCES

A. Applicable codes, standards, and references: inspections and tests shall be in accordance with the following applicable codes and standards:

1. InterNational Electrical Testing Association – NETA.

2. National Electrical Manufacturers Association – NEMA.

3. American Society for Testing and Materials – ASTM.

4. Institute of Electrical and Electronics Engineers – IEEE.

5. American National Standards Institute – ANSI.

6. National Electrical Safety Code – NESC.
7. California Building Code – CBC.
8. California Electrical Code – CEC.
9. California Mechanical Code – CMC.
10. Insulated Cables Engineers Association – ICEA.
11. Occupational Safety and Health Administration – OSHA.
12. National Institute of Standards and Technology – NIST.
13. National Fire Protection Association – NFPA.
14. American Society of Heating and Air-Conditioning Engineers – ASHRAE (The HVAC Commissioning Process, ASHRAE Guideline).
15. Associated Air Balance Council – AABC (National Standards for Total System Balance).

1.03 SUBMITTALS

A. Submittals package shall include the following:

1. Commissioning required submittals in accordance with Division 01 Specification Sections.
2. Copy of the Architect's reviewed and accepted submittals to the CxSP via the OAR.
3. List of team members who will represent the Contractor in the Pre-functional Equipment Checks (PEC) and Functional Performance Tests (FPT), at least six weeks prior to the start of Pre-functional Equipment Checks.
4. Detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, a copy of full details of Owner-contracted tests, full factory testing reports, if any, and Warranty information, including responsibilities of Owner to keep Warranty in force clearly defined.
5. Installation and checklist documentation shipped with equipment and field checklist forms to be used by factory or field technicians.
6. Detailed manufacturer's recommended procedures and schedules for PECs, supplemented by Contractor's specific procedures, and FPTs, at least four weeks prior to the start of PEC.

1.04 MEETINGS, SEQUENCING AND SCHEDULING

A. Meetings: Attend the Cx meetings as required under Section 01 9113 and Cx Plan.

B. Sequencing and Scheduling: The work described in this Section shall begin only after work required in related Divisions 23 and 26 Sections has been successfully completed and tests, inspection reports, and Operation and Maintenance manuals

required have been submitted and accepted. The start-up and PEC shall be completed and submitted to the Owner at least two weeks prior to beginning FPT.

1. Coordinate HVAC work with the work of other trades prior to scheduling of any Cx procedures.
2. Coordinate the completion of HVAC testing, inspection, and calibration prior to start of Cx activities.

1.05 QUALITY CONTROL

A. Comply with Division 01 quality control specifications.

B. Incorporate manufacturer's recommended Cx procedures for the systems and equipment to be commissioned under this Section.

C. Comply with Section 01 4525: Testing, Adjusting, and Balancing for HVAC.

1.06 EQUIPMENT AND SYSTEMS TO BE COMMISIONED

A. Split Systems.

B. Make Up Air Units, with gas fired heat and evaporative cooling.

C. Fan Coil Units.

D. Single Package Gas Heating Electric Cooling Units.

E. Variable Volume and Temperature System.

F. Exhaust Fans.

G. Ventilators.

H. Pumps.

I. Water Heaters, Gas and Electric.

J. Boilers.

K. Chillers.

L. Cooling Towers.

M. Air Handling Units.

N. Air Conditioning Units.

PART 2 – PRODUCTS

2.01 TEST EQUIPMENT

A. Equipment to be utilized in the commissioning process shall meet the following requirements:

1. Provide test equipment as necessary for the testing of the equipment and systems to be commissioned.

2. Provide testing equipment and accessories that are free of defects and certified for use.

3. Provide testing equipment with current calibration labels as per NIST Standards.

4. Equipment shall be calibrated on the manufacturer's recommended intervals with calibration tags affixed to the instrument. In the absence of calibration tags, calibration documentation shall be submitted to the CxSP at least thirty days prior to use; this documentation shall include description and serial number of instrument and calibration data and date.

5. Testing equipment shall be maintained in good operating condition for the duration of the project.

PART 3 – EXECUTION

3.01 COMMISSIONING PROCESS REQUIREMENTS

A. Work to be performed prior to commissioning:

1. Complete phases of the work so the system(s) can be started, tested, adjusted, balanced, and otherwise commissioned.

2. If modifications or corrections to the installed system(s) are required to bring the system(s) to acceptance levels due to Contractor's incorrect installation or defective materials, such modifications shall be made at no additional cost to the Owner.

3. Normal start-up services required to bring each system into full operational state:

a. Testing, motor rotation check, control sequences of operation, full and part load performance.

b. Commissioning shall not start until each system is complete and start-up has been performed.

B. Pre-Commissioning responsibilities:

1. Inspection, calibration and testing of the equipment required to commission the following systems:

a. HVAC System(s).

C. Commissioning Process Requirements:

1. Refer to Section 01 9113: General Commissioning Requirements and related Sections for information on meetings, start-up plans, Pre-Functional and FPT, operations and maintenance data, training requirements, and other Cx activities.

3.02 PREPARATION

A. Provide certified HVAC technicians as required, with tools and equipment necessary to perform Cx activities specified.

B. Provide certified testing agency personnel and equipment factory representatives as require in the Cx plan and other related Sections.

C. Verify that work required in this Section and in Section 01 9113 is complete prior to starting of FPT.

D. Verify that complete operational manuals have been reviewed and accepted by the CxSP as specified before starting FPT.

3.03 TESTING

A. Testing procedures shall include the following minimum information:

1. Test number.
2. Equipment used for the test, with manufacturer and model number and date of last calibration.
3. Date and time of the test.
4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
5. Identification of the system, subsystem, assembly, or equipment.
6. Conditions under which the test was conducted, including (as applicable); ambient conditions, set points, override conditions, status, and operating conditions that impact the results of the test.
7. Systems and assemblies test results and performance and compliance with contract requirements.
8. Issue number, if any, generated as the result of the test.
9. Name(s) and signature(s) of witnesses and the person(s) performing the test.

B. Contractor shall participate and perform Cx related testing requirements as specified.

C. General Requirements for Mechanical, Controls, and Testing and Balance:

1. Construction and Acceptance Phases:

a. Provide assistance to CxSP in preparing FPT procedures specified. Sample test forms are included in the project Cx Plan.

b. Develop full startup and initial checkout plan using manufacturer's start-up procedures and Cx checklists for commissioned equipment. Submit to CxSP for review and approval prior to startup.

c. During startup and initial checkout process, execute mechanical-related portions of PEC for the equipment and systems to be commissioned.

d. Perform and clearly document completed startup and system operational checkout procedure. Providing four copies of the results to the Owner.

e. Resolve any open punch list items before FPT. Air testing and balance shall be completed with discrepancies and problems remedied before FPT of respective air -related systems.

f. Provide skilled technicians to execute starting of equipment and to execute PFT. Ensure that technicians are available and present during agreed upon schedules and for sufficient duration to complete necessary tests, adjustments, and solutions to identified problems.

g. Maintain a log of events and issues of tests and related Cx activities. Submit handwritten reports of discrepancies, deficient or uncompleted work by others, contract interpretation requests, and lists of completed tests as specified.

h. Correct open issues and re-test as needed to prove compliance with system operational standards.

i. Prepare Operation and Maintenance Manuals and provide training for the Owner maintenance personnel and end-users per Section 01 7900.

j. Coordinate with equipment manufacturers to determine specific requirements to maintain validity of Warranty and notify the Owner.

k. Execute simulated seasonal FPT, witnessed by the Owner and the CxSP, as specified. Document results and perform corrections as needed for system acceptance and make necessary adjustments to Maintenance and Operations Manuals and Record Drawings.

3.04 SENSOR CALIBRATION

A. Field-installed temperature, relative humidity, CO_2, pressure sensors, pressure gages, and actuators (dampers and valves) shall be calibrated using the methods described below. Calibration procedures shall be documented during execution of the Start-up and the PEC. Alternate methods may be used, if approved by the CxSP.

B. Test instruments shall have had a NIST certified calibration within the last 12 months. Sensors installed in the unit at the factory with provided calibration certification need not be field calibrated.

C. Sensors:

1. Verify that sensor locations are appropriate and away from causes of erratic operation.

2. Verify that sensors with shielded cable are grounded only at one end.

3. For sensor pairs that determine a temperature difference, make sure they are reading within 0.2 degrees F of each other.

4. For sensor pairs that determine a pressure difference, make sure they are reading within 2 percent of each other.

5. Calibration: Put the equipment in operation. Make a reading with a calibrated test instrument within six inches of the site sensor. Verify that the sensor reading (via the permanent thermostat or gage) is within the tolerance listed in the table below of the instrument-measured value. If not, calibrate or replace sensor.

6. Tolerances:

Sensor	Required Tolerance (+/-)
AHU wet bulb or dew point	2.0 degrees F
Outside air, space air, duct air temps	0.4 degrees F
Watt-hour, voltage, and amperage	1 percent of design
Pressures, air, water and gas	3 percent of sensor range (inc. design value)
Flow rates, air	10 percent of sensor range (inc. design value)
Flow rates, natural gas	5 percent of sensor range (inc. design value)
Relative humidity	4 percent
CO_2 monitor	100 ppm
Sound level	5 db - Type 1 meter (Per Calibrator Mfg.)
Domestic Hot Water Temperature	1.5 degrees F
Domestic Hot Water Pressures Water and Gas	3 percent of sensor range (inc. design value)

Flow Rates, Domestic Water	4 percent of sensor range (inc. design value)
Flow Rates	5 percent of sensor range (inc. design value)

3.05 ADJUSTING

A. Perform work required to rectify installations not meeting contract requirements at no additional cost to the Owner.

B. Corrective work shall be completed in a timely manner to permit completion of the Cx process.

C. If systems' Cx deadline, as defined in the Project Schedule, goes beyond the scheduled completion without resolution of the problem(s), the Owner reserves the right to obtain supplementary services or equipment to resolve the problem.

3.06 TRAINING

A. Provide training plan for systems to be commissioned as required in applicable Division 23 specification sections and Section 01 7900.

END OF SECTION

SECTION 23 3000

AIR DISTRIBUTION

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Ductwork and appurtenances required for a complete air transmission and distribution system for the heating, ventilating, and air conditioning systems indicated on Drawings and as specified.

B. Related Requirements:

1. Division 01: General Requirements.

2. Section 09 9000: Painting and Coating.

3. Section 23 0500: Common Work Results for HVAC.

4. Section 23 0800: HVAC Systems Commissioning.

5. Section 23 0700: HVAC Insulation.

1.02 SUBMITTALS

A. Provide in accordance with Division 01 and Section 23 0500: Common Work Results for HVAC.

B. Manufacturer's Data:

1. Complete list of items to be furnished and installed under this Section. Material lists that do not require performance data shall include manufacturer names, types and model numbers.

2. Manufacturer's specifications and other data required to demonstrate compliance with specified requirements.

3. Literature shall include descriptions of equipment, types, models, sizes, capacity tables or curves marked to indicate performance characteristics, electrical requirements, options selected, space requirements, including allowances for servicing, and other data. Data shall include name and address of nearest service and maintenance organization that regularly stocks repair parts. Listings of items that function as parts of an integrated system shall be furnished at one time.

4. Submit complete acoustical test reports showing that proposed products have been tested in accordance with latest editions of relevant ASHRAE and AHRI

Standards (ANSI/ASHRAE Standard 70 for air inlets and outlets; ANSI/ASHRAE Standard 130 and AHRI 880 for terminal units) and will be suitable for operation in Project spaces with specified maximum noise criteria (NC) requirements. The results of all testing shall be certified by an independent testing agency and submitted to the ARCHITECT for approval. The submittal shall include a complete description of the test conditions, methods and procedures.

5. Submittals shall include a tabulation of proposed products, identification of Project spaces where proposed products are to be installed, maximum allowable NC for all Project spaces, and product NC (at specific design air volume) for all Project spaces.

6. Shop Drawings: Shop Drawings indicating methods of installation of equipment and materials, sizes and gages of ducts, and details of supports. Items to be covered shall include but not be limited to following:

   a. Layout of ductwork and equipment drawn to scale to establish that equipment will fit into allotted spaces with clearance for installation and maintenance. Indicate proposed details for attachment, anchoring to, and hanging from structural framing of building. Indicate vibration isolation units, foundations, supports, and openings for passage of pipes and ducts.

   b. Drawings indicating locations and sizes of sleeves and prepared openings for pipes and ducts.

   c. Typical details of supports for equipment and ductwork.

1.03 QUALITY ASSURANCE

A. Installer's and Manufacturer's Qualifications: Comply with provisions stated under Section 23 0500: Common Work Results for HVAC.

B. Sound power level measurements and Manufacturers' NC value calculations shall be conducted in complete accordance with the latest version of ANSI/ASHRAE Standards 70 and 130 and AHRI 880.

1.04 DELIVERY, STORAGE AND HANDLING

A. Comply with provisions stated in Section 23 0500: Common Work Results for HVAC.

B. Ensure ducts are clean and free of dirt, dust, moisture, oils and other contaminants that can lead to poor air quality. Cover openings of ductwork with a self-adhering protective film. Film shall not leave a residue on metal after removal, and shall be highly resistant to tears and punctures.

1.05 COORDINATION

A. Coordinate activities in accordance with provisions of Section 23 0500: Common Work Results for HVAC.

PART 2 – PRODUCTS

2.01 GENERAL

A. Unless otherwise noted, provisions, including amendments thereto, of the latest edition of the HVAC Duct Construction Standards of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) and the California Mechanical Code (CMC), are hereby made part of this Section.

B. Rectangular, round and flat oval ducts shall be manufactured and installed in accordance with requirements of the latest edition of the HVAC Duct Construction Standards – Metal and Flexible of SMACNA.

C. Sheet metal ducts shall be fabricated from galvanized steel, aluminum or stainless steel.

D. Galvanized steel ducts shall be fabricated of galvanized steel sheet, lock forming grade, conforming to ASTM A653 and A924.

E. Galvanized steel ducts gage thickness and permissible joints and seams of ductwork shall conform to requirements of the latest edition of the HVAC Duct Construction Standards – Metal and Flexible of SMACNA and the CMC unless noted otherwise on the drawings. The more stringent requirements shall prevail.

F. Button punch snap-lock seams, using Lockformer or equal, shall be permitted only in concealed areas using 20 and 22 gage galvanized steel ducts with screws added at the ends. Button punch snap-lock is not permitted for aluminum or duct lighter than 22 gage.

G. Ducts shall be reinforced in accordance with the latest edition of the SMACNA HVAC Duct Construction Standards: Cross-broken Duct: Duct sizes 19 inches wide and larger which have more than 10 square feet of unbraced panel shall be beaded or cross-broken. This requirement is applicable to 20 gage or less thickness and 3 inches w.g. or less pressure. For details, refer to SMACNA manual.

H. Round and Oval Galvanized Steel and Aluminum Ducts:

1. Round Spiral Ducts and Fittings: Fabricated from galvanized sheet steel shall be machine-formed spiral pipe with sealed spiral locking joints. Fittings shall be furnished with continuous corrosion-resistant welds. Provide gages of ducts and fittings recommended by manufacturer.

2. Details of seams and transverse joints for round duct and fittings shall conform to SMACNA standards.

3. Flat oval ducts shall be provided as indicated on the Drawings. Reference standard details in SMACNA manual.

4. Minimum duct wall thickness, and permissible joints and seams of ductwork for flat oval duct construction shall conform to requirements in the latest edition of the HVAC Duct Construction Standards – Metal and Flexible of SMACNA and the CMC. The more stringent requirements shall prevail.

5. These provisions apply for ducts furnished for indoor comfort heating, ventilating and air conditioning service only.

I. Flexible Ducts

1. Flexible duct shall be non-metallic, insulated for conditioned air supply and return. The flexible ducts shall be factory fabricated with exterior reinforced laminated vapor barrier, 1 ½-inch thick fiber glass insulation (K = 0.25 at 75 degrees F), encapsulated zinc-coated spring steel wire helix and impervious, smooth, non-perforated interior vinyl liner and factory fabricated steel connection collars. For the composite assembly, including insulation and vapor barrier, comply with NFPA Standard 90A or 90B and tested in accordance with UL Standard, UL 181. Non-insulated metallic ducts shall be provided for exhaust only.

2. Methods of installations, standards for joining and attaching, and supporting flexible duct shall conform to applicable provisions of SMACNA manual.

3. Specifications herein shall not supersede installation requirements by flexible duct manufacturer if those are more stringent.

J. Aluminum Ducts:

1. Material for aluminum duct shall be of 3003-H14 alloy aluminum sheets, with such designation embossed or stenciled on each sheet. Minimum tensile strength shall be 19,000 psi.

2. Aluminum duct thickness and permissible joint and seams shall conform to requirements of the latest edition of the HVAC Duct Construction Standards-Metal and Flexible of SMACNA, and CMC.

3. Aluminum ductwork shall be furnished to transport moisture-laden air from shower rooms, shower drying rooms, dishwashers and discharge ducts from evaporative condenser and cooling towers.

4. Unless otherwise noted, follow SMACNA Duct Construction Details for steel construction standards as indicated for unreinforced duct, reinforced duct, or cross-broken duct.

5. Button punch snap-lock seams on aluminum ducts are not permitted.

K. Stainless Steel Duct:

1. Materials for stainless steel duct shall be stainless steel conforming to ASTM A167 and A480.

2. Stainless steel ducts shall be provided as required and indicated on the Drawings.

3. Fume hood exhaust shall be stainless steel Type 304.

4. Kitchen exhaust duct system shall be stainless steel Type 304.

5. Stainless steel ducts shall be constructed with welded joints except for connections to equipment which shall be flanged joints with gaskets.

6. Entire stainless steel duct systems shall comply with current CMC requirements for product conveying ducts except where the requirements of this Section are more stringent.

L. Fittings and Other Construction Details: Details of fittings such as elbows, turning vanes, branch take-off and connections, duct access doors, connections for grilles, registers and ceiling diffusers, flexible connector at fan, etcetera, shall conform to applicable provisions of this Section or SMACNA manual.

M. Duct Seam and Joint Sealant: Provide sealant for metal ducts at duct joints which are defined as transverse joints between duct sections including girth joints, branch and sub-branch intersections, duct collar tap-ins, fitting subsections, louver and air terminal connections, access doors and frames, and abutments to building structure. Also provide the same at duct seams which are defined as longitudinal joint between duct sections. Spiral lock seams in factory fabricated round or oval ducts are excluded.

1. Sealant for low-pressure ducts shall be: Design Polymerics DP1010 or DP1020, Childers CP-145A/CP-146 Chil-Flex, Foster's 32-19 Duct-Fas, Miracle-Kingco Glenkote Seal-Flex, Ductmate Industries PROseal or FIBERseal, or equal.

2. Provide sealing material for medium-pressure ducts as described in the SMACNA manual for those pressures.

3. Sealant materials shall comply with the flame spread and smoke developed rating of current CMC when tested in accordance with ASTM E84.

4. Sealant for exposed to weather ducts shall pass the Weather Resistance Test per ASTM G154 at 2000 hours QUV.

N. Restrictions:

1. Zinc-coated steel duct shall not be installed for ductwork transporting moisture-laden air. Flexible duct may only be furnished where specifically indicated on

Drawings. Aluminum ducts shall not be installed for internal pressures above 2 inches of water.

2. Fiberglass duct is not permitted as a substitute for sheet metal duct.

2.02 DAMPERS

A. Manually Operated Volume Control Dampers:

1. VD-1, Rectangular: Multi-blade type, opposed blade operation, 16 gage galvanized steel blades; center pivoted on 3/8 inch diameter steel trunnions; interlocking edges; dampers shall be in own angle frame, full duct size as indicated on Drawings; frame of minimum 16 gage steel channel construction. Provide with damper operator and axles positively locked to blade. Ruskin MD35, Pottorff MD-42, Greenheck MBD-15 or equal.

2. VD-2, Round: Frame shall be constructed of not less than 20 gage galvanized steel, blades of not less than 20 gage galvanized steel channel construction with factory neoprene seals, ½ inch diameter axle shafts and locking hand quadrant. Ruskin MDRS25, Greenheck MBDR-50, or equal.

3. VD-3, Oval: Frame shall be constructed of not less than 14 gage galvanized steel channels with factory blade seals of not less than 12 gage galvanized steel with not less than ½ inch diameter axle shafts. Provide Ruskin standard construction for frame, blade and axle size, thickness and material variation. Provide adjustable locking hand quadrant. Ruskin CDO25, or equal.

B. Motorized Volume Control Dampers:

1. MVD-1, Rectangular: Multi-blade type opposed blade operation, 16 gage minimum steel channel frame construction; 16 gage galvanized steel blades center pivoted on ½ inch diameter steel trunnions. Interlocking edges. Dampers shall be in own angle frame. Full duct size as indicated on the Drawings. Provide with matching two position motorized actuator with linkages, 24VAC by Belimo, Honeywell, Invensys, or equal. Ruskin CD35, Pottorff CD-42, Greenheck VCD Series, or equal.

2. MVD-2, Round: Butterfly type constructed with minimum 20 gage galvanized steel frame with steel angle reinforcement on above 20-inch diameter. Blade shall be 14 gage minimum thickness. Neoprene seal to ensure air tightness in closed position. Furnish with matching two position motorized actuator with linkage 24 VAC by Belimo, Honeywell, Invensys, or equal. Ruskin CDRS25, American Warming and Ventilating (AMV) VC-25, Air Balance, Inc. AC530, or equal.

3. Electronic Damper Actuators: Belimo, Honeywell, Invensys, or equal.

a. Sized for torque required for damper seal at load conditions.

b. Coupling: V-bolt dual nut clamp with a V-shaped toothed cradle. Aluminum clamps or set screws are not acceptable.

c. Overload Protection: Microprocessor or an electronic based motor controller providing burnout protection if stalled before full rotation is reached. Actuator shall be electronically cut off at full open to eliminate noise generation with the holding noise level to be inaudible.

d. Power Requirements: As indicated on Drawings.

e. Actuator Timing: Shall meet 15 seconds.

f. Temperature Rating: Actuator shall have a UL 555S listing by damper manufacturer for 350 F.

g. Auxiliary Switches: Provide for signaling, fan control, and position indications.

A. General:

1. Grilles, registers, diffusers and appurtenances shall conform to requirements specified herein and shall be of type and sizes as specified and indicated on Drawings. Performance shall be in accordance with ANSI/ASHRAE Standard 70 including airflow velocity, pressure, temperature, and sound measurements.

2. Sponge neoprene, rubber, vinyl or felt border gaskets shall be provided for surface-mounted registers, grilles or diffusers.

3. The noise generating characteristics of all specified grilles, registers, and diffusers shall be tested to, and comply with, all requirements of this specification. Representative samples shall be subjected to tests in accordance with applicable standards and procedures in order to demonstrate such compliance. A special test for this project is not required if the manufacturer has previous certified test results that can be made applicable to this project. Maximum Sound Levels of diffusers, grilles and registers shall be as follows:

Administrative office area:	NC 30
Classrooms:	NC 20
Libraries and other noise sensitive areas:	NC 25
Gymnasiums, cafeterias, lockers areas:	NC 30

4. Provide suitable frame types to match the ceiling types as specified or indicated on the Architectural Drawings.

5. Ceiling diffusers shall be provided with equalizing grids.

6. Ceiling mounted grilles, registers and diffusers shall be provided with a factory applied, baked enamel, dull finish, bone white to match acoustical ceiling tile.

7. Grilles or registers mounted on painted walls or other surfaces shall be furnished with a baked prime coat and finish painted in accordance with Section 09 9000: Painting and Coating.

8. Do not provide opposed blade dampers at diffusers and registers to balance the airflow, as they tend to create noise. Provide a manual volume damper at each branch take-off and also at branch duct to each diffuser and register upstream of the flexible duct connections. Air throw patterns shall be as indicated on the drawings.

9. Diffusers, registers and grilles indicated or scheduled on the drawings to comply with special requirements shall take precedence over the standard items specified.

B. Ceiling Diffusers - Round, Square, Rectangular:

1. CD-1 For non-classroom areas of less than 10 feet ceiling height only. Units shall be square or rectangular modular core type as indicated on the drawings. Anemostat QC Series, Krueger Model 1240, Price SMCD Series, or equal.

2. CD-2 For typical classrooms. Units shall be square plaque type. Anemostat PG Series, Krueger Model PLQ, Price SPD Series, or equal. The horizontal air discharge pattern shall be 360-degree radial type with factory installed blank-offs for three way, two way corner, two way opposite, or one way discharge pattern.

3. CD-3 For non-classroom areas of higher than 10 feet ceiling height. Units shall be square or rectangular louver faced type. Anemostat D Series, Krueger Model SH, Price SMD/AMD Series, or equal.

4. CD-4: Units shall be round, adjustable pattern, and surface-mounted type. Anemostat C-27, Krueger RM Series, Price RCDE Series, or equal.

5. CD-5: Units shall be adjustable linear slot type. Anemostat SLAD Series, Krueger Model 1900, Price AS Series, or equal.

C. Grilles - Return, Exhaust, Ceiling, Square, Rectangular:

1. GR-1 Acoustical Tile on Plaster Ceiling: Return and exhaust grilles shall be single deflection type with horizontal fixed face bars set at straight or 45 degree angle, ½ inch spacing and flush and flanged for surface mounting. Anemostat S3HD Series, Kruger Model S80/S85, Price 500/600 Series, or equal.

2. GR-2 Prefabricated Acoustical Tile Ceiling with Inverted Exposed T-Bars: Return and exhaust grilles shall be with single deflection horizontal fixed face bars, set at straight or 45 degree angle, ½ inch spacing and flush, lay-in panel type with nominal overall dimension of 24-inch by 24-inch.

Anemostat Type SAC3L Series, Krueger Model S80/S85, Price 500/600 Series, or equal.

D. Registers, Supply, Return, Wall:

1. WR-1: Sidewall supply register shall be double deflecting type with loose key-operated opposed blade volume control. Anemostat S2 Series, Krueger Model 80/880, Price 500/600 Series, or equal.

2. WR-2: Sidewall return register shall be single deflecting type with horizontal fixed face bars set at 45 degree angle flush and flanged for surface mounting and complete with loose key-operated opposed blade volume control. Anemostat S3 Series, Krueger Model S80/S85, Price 500/600 Series, or equal.

2.03 SOUND ATTENUATING EQUIPMENT - DUCT SILENCERS

A. Provide factory fabricated duct silencers of tubular or rectangular type, for high or low velocity service, with arrangements, sizes and capacities as indicated on Drawings. Construct silencers of galvanized steel with casing seams sealed or welded to be airtight at a pressure differential of 8 inches water gage between inside and outside of unit, and stiffen or brace as required to prevent structural failure or deformation at same condition, or audible vibration during normal operation. Filler material shall comply with the following:

Fire Safety Standards:	NFPA 90A and 90B
Temperature:	ASTM C411
Air velocity:	ASTM C1071, UL 181
Fire Hazard Classification:	ASTM E84, UL 723-Class 1, NFPA 255
Corrosion Resistance:	ASTM C739, C665
Fungi Resistance:	ASTM G21
Water Vapor Sorption:	ASTM C1104, less than 1 percent by weight

Formaldehyde, Phenoloc Resins or other Volatile Organic compounds: 0 percent.

B. Select and provide silencers from acoustical and aerodynamic rating tables based on actual test readings or interpolated values of such readings obtained from tests made by recognized independent laboratories. Tests shall be in accordance with ASTM E477.

C. Select and provide silencers for air pressure drops not exceeding those indicated on Drawings, and of types, sizes and models for which noise reduction values, dynamic insertion loss, in decibels reference 10 to 12 watts, are not less than indicated on Drawings.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which Work of this Section will be performed. Correct conditions detrimental to proper and timely completion of Work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 DUCTWORK

A. Construct ductwork according to details of fabrication and methods of support, as indicated in the SMACNA manuals and CMC, unless specified or indicated otherwise in this Section or on Drawings. In event of conflict, the most stringent requirement shall be provided.

B. Unless otherwise required, construct ducts to conform accurately to dimensions indicated and to be straight and smooth on inside, with joints neatly finished.

C. Duct dimensions indicated are net inside dimensions.

D. Where aluminum is welded, provide a minimum thickness of 16 gage, and use gas inert tungsten process of welding.

E. Anchor ducts to building structural slab, framing and roof decking and detail method of anchoring and fastening if not indicated on Drawings. Supports shall be seismically constructed as required by the latest edition of the SMACNA guidelines.

F. Construct and install ducts to be completely free from vibration under operating conditions.

G. Indicate on layout drawing, required for suspended ductwork, location of supports, loads imposed on each fastening or anchor, typical details for anchorage, and details for special anchorage for supports attached to metal roof decking.

H. Attach supports only to building structural framing members and concrete slabs.

I. Where supports are required between structural framing members, detail and install suitable intermediate metal framing.

J. Ducts transporting air-conditioned or heated supply air shall be insulated in accordance with requirements of Section 23 0700: HVAC Insulation.

1. Ducts exposed to weather shall be prefabricated double wall type from HVAC equipment through building envelope.

K. Ferrous angles and structural members and joining collars specified for construction and support of ductwork and plenums shall be primed with one heavy coat of required asphaltic aluminum paint before installation or fabrication. Metal surfaces shall be thoroughly cleaned before installation of paint. Galvanizing may be provided instead of painting. Installed duct hanger rods concealed in furred ceilings and walls are not required to be primed or painted.

L. Broken places in galvanized coating shall be acid washed and then completely soldered over or painted with galvanizing paint.

3.03 DUCT CONSTRUCTION

A. Minimum ductwork gages, joints, reinforcing, and bracing of ductwork shall conform to SMACNA and CMC. The most stringent standards shall prevail. Additional bracing shall be provided to prevent objectionable panel vibration.

B. Button punch snap-lock seams, using Lock-former or equal, shall be permitted only in non-accessible areas using 20 and 22 gage galvanized steel ducts with screws added at the ends. Button punch snap-lock is not permitted for aluminum or duct lighter than 22 gage.

C. Provide longitudinal seams of the grooved snap lock, or Pittsburg and standing, sealed spiral or continuously welded.

D. Ferrous angles and structural members and joining collars specified for the construction and support of ductwork and plenums shall be primed with one heavy coat of asphalt aluminum paint before installation or fabrication. The metal surface shall be thoroughly cleaned before application of the paint. Galvanizing may be provided instead of painting. Installed duct hanger rods concealed in furred ceilings and walls is not required to be primed or painted.

E. Broken places in galvanized coating shall be acid washed and then completely soldered over or painted with galvanizing paint.

F. S-type or drive-slip type girths or longitudinal seams shall not be furnished for ductwork installed outdoors or mounted on roofs.

G. Broken places in galvanized coating shall be acid washed and then completely soldered over or painted with galvanizing paint.

3.04 DUCT ELBOWS AND TURNING VANES

A. Duct elbows, including supply, exhaust, and return, shall be provided with a centerline radius of 1.5 times duct width parallel to radius whenever possible; centerline radius shall not be less than width of duct parallel to radius.

B. Where space does not permit above radius, or where square elbows are indicated on Drawings, turning vanes shall be installed whether indicated on Drawings or not.

C. Turning vanes shall conform to SMACNA and CMC.

3.05 DUCT JOINTS AND SEAMS

A. Conditioned air supply ducts shall be furnished with joints and seams sealed, welded for air tightness, except spiral seam factory machine formed duct components. Spiral seam

is exempted. Joints between slip-fit components may be assembled with all seams and joint connections fastened with screws.

B. Other ducts shall be furnished with joints and seams sealed by using sealant, taping, soldering, or welding. Ducts for grease hood exhaust shall be furnished with grease-tight welding or brazing on external surface for joints and seams. Fiberglass ducts shall be provided with a thermally activated closure system, Johns Manville Fortifiber Therm-Lock with Automatic Bond Indicator dots, or equal.

C. S-slip or drive-slip type girths or longitudinal seams are not permitted on exterior or exposed rooftop mounted ductwork.

D. Caulking, taping, or other joint or seam treatment shall be provided in accordance with recognized standards.

E. Seams around fan, coil housing and plenums shall be sealed with gaskets or sealing compound to provide an airtight assembly.

F. Stainless steel ductwork connected to range hoods and fume hoods shall be provided with grease-tight, gas tight welded seams, and shall be constructed and installed so that grease or other material cannot become pocketed in any portion thereof, and system shall slope downward toward hood not less than 1/4 inch per lineal foot. Gasketed flanged joints with sealing compound shall be used only at fan and fume hood connections.

G. Alternative duct connectors such as Ductmate Industries, Mez Industries, or equal may be used if the following conditions are met:

1. One of the specifically listed connectors is submitted and approved by the ARCHITECT and OAR.

2. The correct size connector, application, and gage of material conform to SMACNA Standards.

3. The connector is installed per manufacturer's specifications.

3.06 DUCT TRANSITION

A. Slopes in sides of transition pieces shall be no greater than 1 to 5. Abrupt changes or offsets in duct system are not permitted, except when reviewed by the ARCHITECT.

3.07 DUCT TEST HOLES

A. Holes in ducts and plenums shall be provided for pilot or static tubes for obtaining air measurements to balance or check air systems. Holes shall be covered with neoprene gasketed sheet metal cover or plugged with a fitted neoprene plug chained to duct.

3.08 SOUND ATTENUATING EQUIPMENT

A. Install sound attenuators where required and indicated on Drawings. Refer to manufacturer's instructions for required installation.

3.09 FLEXIBLE CONNECTIONS

A. At points where sheet metal connections are installed to fans or air handling units, or where ducts of dissimilar metals are connected, a flexible connection of commercial grade, Duro Dyne Durolon, Ventfabrics Ventglas, Ductmate Industries Proflex, or equal, non-combustible material shall be installed and securely fastened by zinc-coated steel clinch-type bands or a flange type connection. Inlet and outlet openings shall be axially in-line, maximum deviation of centerline shall be less than 5 percent of diameter or shortest dimension of a rectangular inlet of fan or air handling unit, with system at rest. Duct end of connection shall be seismically restrained if more than 4 feet from last support.

3.10 AIR TERMINAL DEVICES

A. General: Install supply devices after ducts, plenums, and casings have been cleaned and blown free of small particles, as specified. Devices shall be aligned to be parallel to ceiling construction or walls and ceiling surfaces, and shall be pulled tightly to compress gaskets and to fit neatly against surfaces.

B. Diffusers: Support surface mounted ceiling diffusers from angles or channels resting on and fastened to ceiling construction. Do not support from ducts. Install lay-in diffusers on T-bar ceilings with hanger wires from each corner and not supported by ceiling structure. Provide sheet metal adaptor box above each diffuser to allow space for volume controller with round collars for connection to round ducts where indicated on Drawings. Fasten duct-mounted diffusers to duct collars.

C. Registers and Grilles:

1. Install wall supply registers at least 6 inches below ceiling, unless otherwise indicated. Locate return and exhaust registers 6 inches below ceiling unless otherwise indicated.

2. Support ceiling diffuser type inlets, registers, and grilles as required above for ceiling diffusers.

3. Fasten wall mounted and duct mounted registers and grilles to flanges of duct collars.

3.11 DAMPERS

A. Manually operated dampers, gravity dampers, fire dampers, and motor operated dampers shall be furnished and installed as specified and indicated. Upon completion of installation, dampers shall be checked, lubricated, and adjusted so that they operate freely, without binding. Dampers shall be of standard commercial manufacture,

complete with damper frame. Where painting is required, they shall be shop finished unless otherwise noted.

1. Provide and install manual volume dampers per SMACNA standards to allow balancing per AABC, NEBB or TABB Procedures and Standards whether indicated on the drawings or not.

2. Balancing dampers shall be installed in main supply ducts from fan discharge plenums, where two or more ducts are connected to each plenum, although such balancing dampers may not be indicated. Each zone shall be provided with a manual volume damper. Sheet metal screws shall be installed through handles and into ducts to lock damper in place after test and balance.

3. Each supply, return, and exhaust branch shall be provided with manual volume dampers.

4. Do not provide opposed blade dampers at air inlets and outlets.

5. Each supply, return, and exhaust inlet or outlet shall be provided with a manual volume damper. This damper shall be a minimum of 5 feet upstream of the air outlet and inlets. An acoustic flexible duct should be provided between the outlet and inlet and the damper for concealed ducts.

6. Dampers installed in accessible locations shall be provided with locking and indicating quadrants. Ventfabrics Ventlok, Duro Dyne, Young Regulator Co., or equal.

7. Dampers installed in ductwork in furred ceiling spaces or in roof spaces with less than 30 inches of clearance below beams, joists, or other construction, and where access panels are not provided shall be furnished with damper rods extended below ceiling and terminated with a concealed damper regulation. Ventfabrics Ventlok, Young Regulator Co., Duro Dyne, or equal.

8. Dampers not identified as splitter, extractor, or butterfly dampers shall be of multi-louver type arranged for opposed blade operation. Damper shall be same dimension as adjoining duct and be tight closing. Blades shall not be greater than 9 inches. Dampers shall be not less than 18 gage steel.

9. Motor operated dampers shall be furnished by temperature control manufacturer as part of temperature control equipment and shall conform to requirements of Section 23 0900: HVAC Instrumentation and Controls.

10. Dampers shall be provided with accessible operating mechanisms. Where operators are exposed in finished portions of building, operators shall be chromium-plated with exposed edges rounded. Splitter dampers are not permitted unless specified and reviewed by the ARCHITECT.

11. Dampers shall not be installed in combustion air ducts.

12. Access panels shall be installed for access at each damper's operating mechanism.

3.12 BACKDRAFT DAMPERS

A. Backdraft dampers shall be installed at locations indicated in accordance with the State of California Building Energy Efficiency Standards, Title 24, CCR.

3.13 DUCT SLEEVES AND PREPARED OPENINGS

A. Furnish duct sleeves for 15-inch diameter ducts or less passing through floors, walls, ceilings, or roof and install during construction of the floor, wall, ceiling, or roof. Install round ducts larger than 15 inches diameter and square and rectangular ducts passing through floors, walls, ceilings or roof through prepared openings. Provide duct sleeves and prepared openings for duct mains and duct branches.

B. Provide one inch clearance between duct and sleeve or between insulation and sleeves for insulated ducts, except at grilles, registers and diffusers.

C. Provide prepared openings for round ducts larger than 15 inches in diameter and for square and rectangular ducts with one inch clearance between duct and openings or between insulation and opening for insulated ducts, except at grilles, registers and diffusers.

D. Provide closure collar of galvanized sheet metal not less than 4 inches wide unless otherwise indicated on Drawings on each side of walls or floors where sleeves or prepared openings are provided except where grilles or diffusers are installed. Install collar tight against surface. Fit sharp edges of collar installed around insulated duct to preclude tearing or puncturing insulation covering vapor barrier. Fabricate collars from round ducts in steel. Provide not less than 4 nails to attach collar where openings are 12 inches in diameter or less and not less than 8 nails where openings are 20 inches in diameter or less.

E. Pack space between sleeve or opening and duct or duct insulation with commercial grade packing yarn.

3.14 FLEXIBLE DUCT RUNOUTS

A. Runouts from branches, risers or mains to air terminal units and outlets may be pre-insulated, factory fabricated flexible ducts complying with NFPA 90A. Flexible ductwork shall not exceed 7 feet in length. When required to suspend flexible ducts, furnish hangers of type recommended by manufacturers of pre-insulated flexible duct and install at intervals recommended. Method of attachment to other components of air distribution system for a vapor-tight joint shall be in accordance with printed instructions of flexible duct manufacturer. Bend radius shall be 1-1/2 times diameter of duct, measured from centerline. Bends greater than 90-degree angle are not permitted. Non-metallic flexible duct shall be permitted only in T-bar suspended ceilings.

3.15 DUCT HANGERS AND SUPPORTS

A. Exposed or easily accessible ductwork: All exposed ducts shall be supported by all-thread Rod as a single hanger and or a trapeze support for rectangular duct work in accordance with requirements of the latest edition of the HVAC Duct Construction Standards – Metal and Flexible of SMACNA.

B. Non-accessible ductwork: Non-exposed and hidden from sight during regular school operations ductwork, rigid round, rectangular, and flat oval metal ducts, shall be installed with support systems conforming to SMACNA Standards.

C. Where ducts are installed one above the other, they shall be individually supported on a trapeze of steel angles with 3/8 inch supporting steel rods securely fastened to overhead construction. A minimum distance of 3 inches shall be maintained between ducts wherever possible, but in no event shall distance be less than 2 inches. Minimum sizes of steel angles shall be 1 ½-inch by 1 ½-inch by 1/8 inch for duct sizes through 60 inches in greatest dimension, 2-inch by 2-inch by 1/8 inch for duct sizes 61 inches through 84 inches, 2-inch by 2-inch by 3/16 inch for duct sizes 85 inches through 96 inches, and 2-inch by 2-inch by 1/4 inch for duct sizes over 97 inches.

D. Ducts six square feet area and greater and or minimum 28” round or greater shall be seismically restrained. Refer to Section 23 0548: HVAC Sound, Vibration and Seismic Control.

E. Hangers shall not be supported by, or fastened to, non-structural members including blocking. Toggle or Molly type bolts are not permitted.

F. Vertical ducts shall be supported with suitable angles on each side of each duct located at each floor and at intervals not to exceed 8 feet. Angles shall be sized and installed according to SMACNA Standards for required span so that they will be rigid, without bending or sagging.

G. Roof-mounted ductwork shall be installed a minimum 12 inches above roof and shall be supported by galvanized welded pipe, one on each side, fastened to roof structure, flashed and sealed to roof membrane. Install supports at each turn, unit connections, and each penetration, and space at maximum 6 feet off-center in general. Pitch pockets are not allowed.

3.16 ACCESS PLATES AND DOORS

A. Access plates and doors shall be furnished and installed where stops, valves, fire dampers, fusible links, coils, damper operating mechanism, control equipment, lubrication fittings, air filters, air handling equipment and similar items normally requiring adjustment or servicing are installed in concealed spaces.

B. Access plates and doors shall be located to permit convenient access to equipment sized to permit removal of equipment for servicing. Access plates shall be no less than 12-inch by 12-inch in clear opening. Proper servicing of equipment requires adequate

access for maintenance personnel. Access doors shall not be less than 24-inches by 24-inch, unless otherwise detailed. Two or more valves shall not be located in same access area unless sufficient clearance is provided for operation, servicing and removal of each valve.

C. Openings in ducts or plenums whose longer dimension does not exceed 12 inches may be covered by a plate of same material as duct, gasketed and fastened to duct or plenum with sheet metal screws.

D. Access plates in floors shall not be less than 8-inch by 8-inch and shall be carborundum surface brass with cast brass frames anchored into concrete. Access plates in tile walls shall be chromium plated brass and polished. Serrated plates furnished as part of a clean-out assembly are permitted in floors instead of a separate plate.

E. Access plates and doors in walls and ceilings of finished rooms and in locations normally accessible to students shall be furnished with continuous piano hinges, unless otherwise specified, and a special flush type spring-loaded latch requiring an Allen wrench to operate. Access devices shall be installed after plastering in plaster ground openings.

F. Access panels or doors penetrating one-hour fire resistive ceilings shall meet code requirements for such openings.

G. Access panels shall be fire-rated; Milcor, or equal. Access doors shall be as required for installation in openings penetrating one-hour fire resistive ceilings. Access doors shall be furnished with a flush, key-operated cylinder lock, furnished with two keys each, instead of Allen headlock for non-rated ceilings.

H. Access panels that are part of an integrated ceiling are specified in Section 09 8433: Cementitious Wood Fiber Acoustical Units. Identification markers shall be affixed to adjacent supports, under this portion of Work, to indicate location and type of mechanical device to be serviced.

I. Access panels installed in ducts or plenums located in heater or equipment rooms containing gas-fired equipment shall be furnished with heavy-duty spring closing hinges and refrigerator door type catches unless otherwise required. When these panels are intended for maintenance personnel access, catches shall be operable from both interior and exterior.

J. Other access panels, except those specified above, shall be furnished with suitable hinges and one or more sash fasteners.

K. Panels located in ducts and plenums shall be installed with gaskets made of synthetic rubber, felt, or similar material to provide an airtight installation. Panels shall be constructed and reinforced to prevent vibration.

L. Label the words "FIRE DAMPERS" on panels over fire dampers and words "DO NOT OPEN - HEATER IS OPERATING" on panels located in heater or equipment rooms. Letters shall be approximately 3 inches high, if space is available.

M. Furnish a key to operate latch access plates, one for each access plate, but not to exceed five keys for any one Project.

N. Access plates and panels shall be furnished with manufacturer's name or trade mark and model number cast or stamped thereon, or upon a label permanently affixed thereon.

O. Provide duct through roof flashing as detailed in the SMACNA standards or as indicated on Drawings.

P. Refer to SMACNA for access plate and door construction.

3.17 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose off the Project site.

3.18 PROTECTION

A. Protect the Work of this Section until Substantial Completion.

END OF SECTION

SECTION 26 0100

BASIC MATERIALS AND METHODS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Addenda, Alternates, Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specifications collectively apply to work of this Section.

1.02 WORK INCLUDED

A. The specifications and drawings are intended to cover a complete installation of systems. The omission of expressed reference to any item of labor or material for the proper execution of the work in accordance with present practice of the trade shall not relieve the Contractor from providing such additional labor and materials.

B. All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of electrical system, complete, as shown on the drawings and/or specified herein. Work includes but is not necessarily limited to the following:

1. Conduits for all wiring systems, unless otherwise specifically noted.

2. All electrical wiring and connections to equipment furnished under other sections of Specifications.

3. All electrical wiring and connections to Owner furnished equipment.

4. All wiring and conduit for Air Conditioning and Heating and Ventilating systems, and electrical equipment in Plumbing Section of work.

5. Time clocks and contactors for control of lighting and air conditioning.

6. Pull wires in conduit runs indicated as conduit only (CO).

7. Lighting panelboards.

8. Building electrical wiring, conduits, outlet boxes, junction boxes, convenience outlets, switches, plates and all miscellaneous items of electrical equipment, apparatus and material specified and/or shown on Drawings.

9. Disconnect switches, magnetic motor starters and manual motor starters.

10. All required grounds.

11. All anchors, chases, sleeves and supports for electrical equipment.

12. Excavation necessary for execution and completion of electrical work.

13. Required backing, supports and blocking for lighting fixtures.

14. Complete Fire Alarm and Detection System.

15. Complete Intrusion Alarm System.

16. Complete Public Telephone System.

17. Complete Intercom and Public Address System.

18. Complete Master Clock System.

19. Complete Class Change Signal and Program System.

20. Computer Network Wiring System.

21. Tests of entire system.

22. Lighting fixtures complete with lamps and required accessories.

23. Guarantees.

24. Temporary power for building construction.

25. Temporary lighting during construction.

26. Complete connections to all motors, apparatus, electrically operated devices, etc., as shown on Drawings.

27. Circuits, switches, starters and connections for all exhaust fans, blowers and heaters.

28. Flashing of conduits through roof.

29. Shop Drawings.

30. Include an allowance of $500.00 for the material cost of any lighting fixture where an outlet is shown on drawings without a fixture type designation or if the fixture type designation shown is not in the lighting fixture schedule.

31. In these specifications, Fire Alarm, Clock and Class Change Signal, PA/Intercom, Television, Intrusion Alarm, etc. are referred to as Auxiliary Systems or Signal Systems.

1.03 GUARANTEE

A. In addition to guarantee required in Division 01 or specifically specified elsewhere, all materials and equipment provided and installed under this Division of Specifications shall be guaranteed by Contractor in writing for a period of one year from date of acceptance of work by Owner. Should any trouble develop during this period due to defective materials or faulty workmanship, the Contractor shall furnish all necessary labor and materials to correct the trouble without costs to Owner.

B. Guarantee complete and perfect operation of entire system and that all apparatus will perform in accordance with detailed drawings and Specifications.

C. Guarantee that all equipment will be supported in such a way as to be free from objectionable vibration and noise.

D. Guarantee that all licenses and royalties for use of any patented feature of system will be paid before acceptance of system.

1.04 GENERAL REQUIREMENTS

A. Codes: Construct project in accordance with following codes and regulations.

1. 2022 California Electrical Code (CEC), Part 3, Title 24 C.C.R.

2. 2022 California Mechanical Code (CMC), Part 4, Title 24 C.C.R.

3. 2022 California Plumbing Code (CPC), Part 5, Title 24 C.C.R.

4. 2022 California Energy Code, Part 6, Title 24 C.C.R.

5. 2022 California Historical Building Code, Title 24 C.C.R.

6. 2022 California Fire Code, Part 9, Title 24 C.C.R.

7. 2022 California Existing Building Code, Title 24 C.C.R.

8. 2022 California Green Building Standards Code (CAL Green Code), Part 11, Title 24 C.C.R.

9. 2022 California Referenced Standards Code, Part 12, Title 24 C.C.R.

10. Local codes and ordinances.

11. Division of State Architect.

Keep a copy of applicable code available at Site while performing work of this Section. Nothing in these Drawings and Specifications to be construed as authority to violate codes and ordinances. Conflict with applicable regulations to be resolved at Contractor's expense before installation.

B. Permits, Fees and Inspections: Obtain and pay for all necessary permits and fees required by any constituted authority having jurisdiction including utilities. Arrange and pay for all required inspections or examinations and deliver certificates of inspection to Architect.

C. Record Drawings:

1. Provide record drawings for work of this Section.

2. Keep up-to-date a complete "As-Built" record set of blueline prints corrected daily and showing every change from original Drawings and Specifications and exact "As-Built" locations, sizes, and kinds of equipment.

3. Prints for this purpose may be obtained from Architect at cost of printing. Keep this set of Drawings on job and use only as a record set.

4. Drawings to serve as work progress sheets. Make neat and legible notations in red ink thereon daily as work proceeds, showing work as actually installed. Drawings to be available at all times for inspection, and kept at a location designated by Architect.

5. On completion of work, obtain one set of prints from Architect at cost of printing, and note neatly in scale all changes on record set. Deliver complete set of prints together with one set of blueline prints to Architect together with Contractor's name, address and phone number. Incorrect, non-legible or non-reproducible drawings will not be accepted.

D. Selection and Ordering of Equipment and Materials: Within two weeks after award of Contract, arrange for purchase and delivery of all light fixtures, equipment and materials required in ample quantities and at proper time. Inform Architect immediately of any inability to obtain suitable delivery of any equipment or material. Send copy of letter verifying date of purchases to Architect.

E. Shop Drawings and Material Lists:

1. Submit material lists and shop drawings as called for in Division 01, and as supplemented by this Division, and with sufficient promptness to ensure that overall work of project will not be delayed.

2. Submit six copies of a list of materials and equipment manufacturers that Contractor intends to use.

3. Provide shop drawings for following:

    a. Circuit Breakers.

    b. Lighting fixtures, lamps and necessary accessories.

    c. Time switches.

    d. Magnetic Motor Starters.

    e. Fuses.

    f. Flush floor boxes, covers and carpet flanges.

    g. Disconnect switches.

    h. Wall dimmers and dimmer panel.

4. Do not fabricate work until reviewed shop drawings for work have been received from Architect. Work fabricated or erected in advance of reviewed shop drawings will be at risk of Contractor.

5. Architect's or Engineer's review of shop drawings does not relieve Contractor of responsibility for errors including details, dimensions, or materials, as well as conformance with requirements of Drawings and Specifications.

6. Shop drawings will be checked by Architect and Engineer for conformance to design as a convenience to Contractor. Dimensions will not be checked. Should interferences become evident, notify Architect immediately so that matter may be resolved prior to proceeding with fabrication.

7. No reimbursement based on a claim that work was placed in accordance with dimensions shown on a reviewed shop drawing will be allowed for removing or replacing work already in place.

8. Make available a copy of every reviewed shop drawing at Project Site.

9. Submit shop drawings in coherent groups; e.g., all lighting fixtures at one time.

10. Submit actual samples of specified equipment or material to Architect for review when requested.

F. Substitution and Approval of Material:

1. Base all bids and proposals only upon materials, construction and equipment named or described in specification and/or shown on drawing. Should a Contractor wish to use other equipment than that specified, he shall submit proposed substitution by fully describing equipment he prefers to use and by listing credit or additional cost to his bid as a separate item should substitution be acceptable.

2. All equipment and materials proposed for substitution shall be similar in design and equal in quality and function to those specified herein or on drawings. Contractor (not sales vendor) shall demonstrate his proposed substitution and shall specifically note all differences between item specified and proposed substitution. Actual samples and test data, certified by an independent testing laboratory, shall be submitted when requested.

3. Each substitution will be given consideration, but without any obligation expressed or implied on part of Architect to change named requirements of specification. Only one substitution for each item of equipment will be permitted. Contractor assumes sole responsibility for performance and space requirements for substitute equipment. Decision of Architect shall be final as to whether or not substitution is acceptable.

G. Terminology:

1. Term "provide" used on Drawings and elsewhere in the Specifications shall be considered to mean "furnish and install".

2. Term "UL" means Underwriters Laboratories Inc.

H. Workmanship: See supplementary Conditions, Architect is sole judge of whether execution is in a workmanlike manner.

I. Safety Conditions: Be responsible in preventing energized switches, circuit breakers or circuits from being turned to "On" position during construction period. Be responsible for damages to personnel and/or property resulting from contact with energized circuits, switches, circuit breakers, busses or other electrical apparatus. Construct all electrical work with electrical system de-energized in area. At no time permit work on equipment or apparatus with energized circuits.

J. Verification of Dimensions: All scaled and figured dimensions are approximate and are given for estimating purposes only. Before proceeding with work carefully check and verify all dimensions and sizes and assume all responsibility for fitting of materials and equipment to other parts of equipment and to structure. Where apparatus and equipment have been indicated on drawings, dimensions have been taken from typical equipment of class indicated. Carefully check drawings and see that equipment will fit into spaces provided.

K. Locations:

1. Locations of conduits, outlets, apparatus and equipment indicated on drawings are approximate only and shall be changed to meet architectural and structural conditions as required.

2. Install conduit and equipment in a manner and in locations avoiding all obstructions, preserving headroom, keeping openings and passageways clear and readily accessible for maintenance and repairs. Make changes in locations of conduit or equipment which may be necessary to accomplish this. Drawings are essentially diagrammatic to extent that many offsets, bends, special fittings and exact locations are not indicated. Examine all drawings prepared by manufacturers, suppliers and installers of all equipment including air conditioning and plumbing fixture shelving, for requirements and locations of equipment and outlets.

3. Should any structural interferences prevent installation of outlets, setting of cabinets for lighting panelboards, running of conduits, or installation of other electrical equipment at locations shown on Drawings, necessary minor deviations therefore as determined by Engineer may be permitted. In event changes in indicated locations or arrangements are necessary due to developed conditions in building's construction or rearrangement of furnishings or equipment, Owner shall be permitted to move any junction box or utility outlet a distance of 10' and such changes shall be made without extra cost providing change is ordered before work is installed. Submit an estimate of cost or credit for other changes and proceed only upon written authority of Architect.

4. Be cautioned that diagrams showing electrical connections are diagrammatic only and must not be used for obtaining lineal runs of wiring or conduit. Wiring diagrams do not necessarily show exact physical arrangement of equipment.

5. Locations of outlets, lighting fixtures, cabinets, panelboards, apparatus, motors, mechanical equipment, etc., shown on Electrical Drawings is only approximate. Do not scale them from Electrical Drawings.

6. Verify locations of outlets, lighting fixtures, equipment etc., with Architectural Drawings of interior and exterior details and finish, and coordinate location of electrical work with mechanical and other equipment.

7. Locate lighting fixtures as per reflected ceiling plans prepared by Architect.

L. These Specifications and attendant Drawings are intended to cover a complete and operable electrical system. Follow Drawings and Specifications and execute all work according to true intent and meaning. Should any error or omission exist in either or both of these Drawings and Specifications, or conflict one with another, have same explained and adjusted by Engineer before submitting bid price for electrical work; otherwise at own expense, supply proper materials and labor to completely install same, make good any damage to or defect in work of results obtained therefore caused by such error, omission or conflict. Most restrictive, greater quantity or size, better quality or other superior condition of all representations shall prevail. It is intended that outlets be located symmetrical with Architectural elements notwithstanding fact that locations indicated on Drawings may be distorted for clarity.

M. Omission of expressed reference in Drawings or Specifications to any item of labor or material necessary for proper execution of work in accordance with present good practice of trade will not relieve Contractor from providing such additional labor and materials.

N. Job Visits by Engineer: Periodic visits to job by Engineer is for express purpose of verifying compliance by Contractor with contract documents. Such visits by Engineer shall not be construed as construction supervision. Neither shall such visits be construed to make Engineer responsible for providing a safe place for performance of work by Contractor or Contractor's employees or safety of supplies of Contractor or his subcontractors.

O. Cooperation with Others: Organize work that will harmonize with work of all trades so that all work may proceed as expeditiously as possible. Be responsible for correct placement of work and connection of work to all related trades.

P. Protection of Finish: Provide adequate means for protecting all finished parts of materials and equipment against damage from any cause during progress of work and until acceptance by Architect. Cover all material and equipment in storage and during construction in such a manner that no finished surfaces will be damaged, marred or splattered with paint. Keep moving parts perfectly clean and dry. No paint spraying will be permitted in building. Replace or refinish damaged material or equipment including face plates or panels without additional costs to Owner.

Q. Cleaning Equipment and Premises: Thoroughly clean all parts of materials, equipment and exposed parts such as receptacles and panelboards, of cement, plaster and other materials. Remove all oil and grease spots with a non-inflammable

cleaning solvent. Brush exposed metal work with steel brushes to remove rust and other spots and leave smooth and clean. During progress of work, carefully clean up and leave premises and all portions of building free from debris. At completion of work, remove all waste materials and debris resulting, leaving everything in a complete and satisfactory condition.

R. Cutting and Patching: Include all cutting and patching in bid. Do not cut any structural members without first having received written permission from Architect. Cutting of round openings which can be done by use of a rotary drill shall be done by Contractor requiring same. Cutting and patching finish work shall be performed by workmen of the respective trade.

S. Conditions at Site: Visit Job Site and become familiar with all existing conditions within scope of work and include in Bid Proposal allowance for these conditions. Verify exact locations of services prior to construction. Notify all other Contractors of these utility locations.

T. Documents: Read all relevant documents, become familiar with job, scope of work, type of general construction, Architectural, Structural, Mechanical and Electrical Drawings and Specifications. Also become familiar with purpose for which these Drawings have been prepared and become cognizant of all details involved.

U. Acceptance: Before work will be accepted, demonstrate to Owner and Architect that entire installation is complete and in proper operating condition and Contract has been fully and properly executed. Following items shall be prepared and submitted to Architect:

1. Two copies of all test results required under this Division.

2. Two copies of local and/or state code enforcing authorities final inspection certificates.

3. Copies of as-built record drawings as required.

4. Notify Architect in writing when installation is complete and that a final inspection of this work can be performed. In event defects or deficiencies are found during this final inspection they shall be corrected to satisfaction of Architect before final acceptance can be issued.

5. Two Maintenance and Operating Manuals as required.

V. Field Inspections: Provide proper facilities for access of Owner or Owner's representative to conveniently examine and inspect all portions of work covered in this Contract at any and all reasonable hours.

W. Completing Work: At completion of work, remove all waste materials and debris resulting from work, leaving everything in a complete and satisfactory condition.

X. Electrical Superintendent: Include services of a qualified electrical foreman capable of interpreting intent of Drawings and Specifications, to study Plans, Specifications and references, and coordinate all requirements with other trades, authorized to make decisions and issue instructions; be constantly in charge of work and available at job site at all times and at final inspection. Instruct Owner's representative for proper operation and recommend maintenance of all systems.

Y. Maintenance and Operating Manuals:

1. Before completion and acceptance of work, furnish Owner with two complete sets of operating and maintenance instruction manuals. Bind each set in durable hardboard binder and index.

2. Compile data for manuals upon approval of material list and sketches so as not to delay final approval of work installed. Operating manuals to contain all pertinent data relating to electrical installation such as fixture cuts, manufacturer's approval, shop drawings, sketches, wiring diagrams and equipment operating instructions.

3. Instruct Owner's operating personnel with electrical operating procedures before work is considered complete.

Z. Extra Work or Costs to This Contractor Due to Other Contractors or Trades: Adjusted between this Contractor and offending Contractor at no extra cost to Owner. Notify Architect before such extra work is done.

AA. Tests:

1. Upon completion of work and adjustment of all equipment, all systems shall be tested under direction of Owner's representative to demonstrate that all equipment furnished and installed and/or connected under provision of these Specifications shall function electrically in manner required. All tests shall be completed prior to final inspection of project.

2. All systems shall test free from short circuits and grounds and shall be free from mechanical and electrical defects. All circuits shall be tested for proper neutral connection.

3. All instrumentation and personnel required for testing shall be furnished by Contractor.

BB. Noise Control:

1. Perform electrical work to a manner in minimize transmission of noise and preserve acoustical properties of building structure.

2. Where equipment is mounted on vibration isolators, use flexible connections to reduce transmission of noise.

3. Where conduits pass through sleeves in interior walls, floors, or ceilings, completely fill space between each conduit and its sleeve to provide an airtight seal.

4. Use glass fiber material, "Duxseal" compound, for acoustic seals.

CC. Seismic Bracing Standards: All pipes, cable trays, conduits, etc. shall be supported and braced in accordance with SMACNA "Seismic Restraint Manual, Guidelines for Mechanical Systems", including Appendix B, "Additional Requirements for OSHPD" and "Addendum no. 1, September 2000". Comply with CBC, where requirements are more stringent than SMACNA, including, but not limited to the following:

1. Pipes and conduit shall be braced to resist the forces prescribed in California Building Code.

2. Where possible, pipes, conduit and their connections shall be constructed of ductile materials (copper, ductile iron, steel or aluminum and brazed, welded, or screwed connections.) Pipes, conduits and their connections, constructed of nonductile materials (e.g., cast iron, no-hub pipe and plastic), shall have the brace spacing reduced to one-half of the spacing allowed for ductile material in accordance with California Building Code or SMACNA Seismic Restraint Manual.

3. Seismic restraints may be omitted for the following conditions:

   a. All piping suspended by individual hangers 12 inches or less in length from the top of the pipe to the bottom of the structural support for the hanger.

   b. All electrical conduit less than 2.5 inches trade size.

4. For rigidly supported, electrical conduit, or cable trays, the product of $C_a l_p$ need not to exceed 1.2 for any value of l_p.

5. All Trapeze assemblies supporting, cable trays and conduit shall be braced to resist the forces and relative displacements per ASCE 7 Chapter 13, considering the total weight of the elements on the trapeze.

6. Conduit supported by a trapeze where none of these elements would individually be braced need not be braced if connection to the pipe/conduit of directional changes do not restrict movement of the trapeze. If this flexibility is not provided, bracing will be required when the aggregate weight of the pipes and conduit exceed 10 pounds/foot. The weight shall be determined assuming all pipes and conduits are filled with water.

DD. Bracing Standards Application: Comply with bracing standards by evaluating the complete installation of all utilities and equipment, and providing a comprehensive solution based on Contractor's layout, coordination withal other trades, and with the structural design and all other provisions for incorporating systems into the buildings. Show bracing products and layout in shop drawing submittals. The following criteria apply to the bracing of all systems:

1. The design parameters for determining the Total Design Lateral Force shall be as designated on the structural drawing.

2. Seismic Hazard Levels (SHL) shall be as designated on structural drawings.

3. Contractor shall submit documentation for each condition, which is not specifically covered in the SMACNA manual, including piping configurations and conditions, structural systems, structural connection methods, and other issues regarding the application of the standards.

4. Provide expansion anchors, sized per SMACNA guidelines, for use in concrete.

5. For connections to structural steel, wood framing, etc. provide bolted or welded connections, sized per SMACNA guidelines.

6. Seismic bracing components consisting of structural shapes.

7. Seismic bracing cable shall be galvanized steel, conforming to ASTM A603, zinc-coated with minimum 0.4 ounces/sf, pre-stretched, 7 x 19 strand, sized per SMACNA guidelines.

EE. In hard ceiling space where access to j-boxes, detectors, etc is required, provide ceiling access panel, fire-rated typical.

END OF SECTION

SECTION 26 0160

ELECTRICAL DEMOLITION FOR REMODELING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Addenda, Alternates, Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specifications collectively apply to work of this Section.

1.02 DESCRIPTION

A. Work includes but is not limited to the following:

1. Electrical demolition.

PART 2: PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3: EXECUTION

3.01 EXAMINATION

A. Verify that abandoned wiring and equipment serve only abandoned facilities.

B. Drawings are based on field observation and existing record documents. Report discrepancies to Architect/Engineer before disturbing existing installation.

C. Beginning of demolition means installer accepts existing conditions.

3.02 DEMOLITION

A. Provide all necessary electrical demolition. See Architectural drawings for extent of wall removal and other demolition. Remove existing electrical devices in walls to be demolished. Re-route and reconnect as required, any active circuits feeding through these walls in order to keep upstream and downstream circuits active. Remove exposed conduit, wiring, devices, etc. as required.

B. Where new lighting is shown in an area with existing lighting, demolish existing lights, associated conduits, wires, devices, etc. Dispose of existing ballasts with PCB in accordance with all regulations of all governing agencies having jurisdiction.

C. Where mechanical equipment is to be demolished as shown on mechanical drawings, demolish disconnect switches, conduits, wires and associated electrical equipment.

D. Dispose of all demolished equipment and devices. Equipment with salvage value shall be disposed of per District's instructions.

END OF SECTION

SECTION 26 0519

WIRE AND CABLE-RATED 600 VOLT

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Addenda, Alternates, Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specifications collectively apply to work of this Section.

1.02 DESCRIPTION

A. Work includes but is not limited to the following:

1. Building wire.
2. Ground Conductors.
3. Wiring connections and terminations.
4. Conductor Identification.

B. Related Work:

1. Section 260100 - Basic Materials and Methods.
2. Section 260526 - Grounding.
3. Section 260533 - Conduit.
4. Section 260553 - Electrical Identification.

PART 2: PRODUCTS

2.01 BUILDING WIRE

A. Wires shall be single conductor type THHN or THWN insulated with polyvinyl chloride and covered with a protective sheath of nylon, rated at 600 volts. Wires may be operated at 90 degrees C. maximum continuous conductor temperature in dry locations, and 75 degrees C. in wet locations and shall be listed by UL Standard 83 for thermoplastic insulated wires, listed by Underwriter's Laboratories (UL) for

installation in accordance with Article 310 of the California Electrical Code (CEC). Conductors shall be solid copper for 12 AWG and smaller conductors, and stranded copper for 10 AWG and larger conductors. Conductors shall be insulated with PVC and sheathed with nylon. Wires shall be identified by surface markings indicating manufacturer's identification, conductor size and metal, voltage rating, UL symbol, type designations and optional rating. Indentations for lettering are not permitted. Wires shall be tested in accordance with the requirements of UL standard for types THWN, or THHN.

B. Conductors shall be solid Class B or stranded Class C, annealed uncoated copper in accordance with UL standards, or another Nationally Recognized Testing Laboratory (NRTL).

C. Control Circuits: Copper, stranded conductor 600 volt insulation, THWN/THHN.

D. Minimum branch circuit wiring: No. 12 AWG copper, 600 volt insulation.

E. Minimum wire size except for control wiring: No. 14 AWG copper, 600 volt insulation.

2.02 GROUND CONDUCTORS

A. Equipment ground: Insulated conductor green in color.

B. Ground Wires: Bare copper or with green colored insulation.

2.03 CONDUCTOR ARRANGEMENT AND IDENTIFICATION

A. Ties: T & B "Ty-rap" or 3M Company.

B. Lacing: Nylon twine.

C. Markers: Adhesive type, Brady.

2.04 CONDUCTORS

A. All Wire: New and delivered to job site in unbroken packages.

B. Each package shall bear Underwriter's and Manufacturer's labels and seals indicating date of manufacture and maximum allowable voltage.

PART 3: EXECUTION

3.01 INSTALLATION

A. Wires shall not be installed until debris and moisture is removed from conduits, boxes, and cabinets. Wires stored at site shall be protected from physical damage until they are installed and walls are completed.

B. Wire-pulling compounds furnished as lubricants for installation of conductors in raceways shall be compounds approved and listed by UL, NRTL, or equal. Oil, grease, graphite, or similar substances are not permitted. Pulling of 2 AWG or larger conductors shall be performed with a cable pull machine. Any runs shorter than 50 feet are exempt. When pulling conductors, do not exceed manufacturer's recommended values

C. At outlets for light, power, and signal equipment, pigtail splices with 8-inch circuit conductor leads for connection to fixtures, equipment, and devices.

D. Pressure cable connectors, pre-insulated 3M Scotchlok, Hubbell Power, O-Z/Gedney or equal, Y, R or B spring-loaded twist-on type, may be furnished in splicing number 8 AWG or smaller wires for wiring systems; except public address and telephone systems.

E. Joints, splices, taps, and connections to switchboard neutral, bonding or grounding conductors, conductors to ground busses, and transformer connections for wires 6 gage and larger shall be performed with high-pressure cable connectors approved for installation with copper conductors. Connectors shall be insulated with heavy wall heat shrink WCSM, or cold-applied roll-on sleeve RVS. Insulation level shall be a minimum of 600V and joints, splices, and taps shall be qualified to ANSI C 119.1, UL, NRTL, or equal listed mechanical pressure connections.

F. Connections to any bussing and high-press cable connectors shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade five machine screws secured with constant pressure-type locking devices.

G. Connection of any bonding or grounding conductors shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade five machine screws secured with constant pressure-type locking devices.

H. Wire switchboards, panel cabinets, pull boxes, and other cabinets except public address, shall be neatly grouped and tied in bundles with nylon ties at 10-inch intervals. In switchboards, panels and terminal blocks, wires shall be fanned out to terminals. If bundles are longer than 24 inches, a maximum of nine current carrying conductors may be bundled together.

I. Install conductor lengths with a minimum length within the wiring space. Conductors must be long enough to reach the terminal location in a manner that avoids strain on the connecting lug.

J. Maintain the conductor required bending radius.

K. Neutral conductors larger than 6 gage, which are not color identified throughout their entire length, shall be taped, painted white or natural gray, or taped white where they appear in switchboards, cabinet, gutters or pull boxes. Neutral conductors 6 gage and smaller shall be white color identified throughout their entire length.

L. Fire alarm and clock wiring shall be continuous from terminal cabinets or from equipment to each device. Splices are not permitted between devices and/or terminal cabinets at junction and pull boxes. Wiring shall be terminated at terminal blocks or devices only.

M. Wiring systems shall be free from short circuits and grounds, other than required grounds. The contractor shall be responsible for the testing of feeder and branch circuit conductor's insulation resistance. The insulation of the conductors shall be tested prior to connections to any panelboards, switchboards, variable frequency drives, lighting control systems, ballasts, and wiring devices such as but not limited to GFI receptacles, TVSS receptacles, or equipment. Insulation testing of panelboards and switchboards shall be independently performed from the insulation testing of any conductors as specified in other sections of this specification.

1. Utilize the services of an approved independent testing laboratory to perform megger time-resistance insulation testing of feeder conductors. Tests must be conducted with wires disconnected at both ends.

a Provide calibration program records to assure the testing instrument to be within rated accuracy. The test equipment accuracy shall be in accord with the requirements stated by the National Institute of Standards and Technology (NIST).

b Test equipment shall be provided with a label stating the date of last calibration. As a minimum the equipment shall have been calibrated within the past 12 months.

c Test reports shall include the following:

(1) Identification of the testing organization.
(2) Equipment identification.
(3) Ambient conditions.
(4) Identification of the testing technician.
(5) Summary of project.
(6) Description of equipment being tested.
(7) Description of tests.
(8) Test results.
(9) Analysis, interpretation and recommendations.

3.02 COLOR CODES

A. General Wiring:

1. Color code conductor insulation as follows:

SYSTEM VOLTAGE		
Conductor	208Y/120	480Y/277
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Natural Gray

Neutrals shall be colored-distinguished if circuits of two voltage systems are used in the same raceway.

2. For phase and neutral conductors 6 gage or larger, permanent plastic-colored tape may be furnished to mark conductor end instead of coded insulation. Tape shall cover not less than 2 inches of conductor insulation within enclosure.

B. Signal Systems: Wires for signal systems shall be color-coded. Except where otherwise specified, color-coding shall be as follows:

SYSTEM	COLOR CODE
Clocks	Pink, Gray and Orange
Fire Alarm Horns	Pink (+) and Gray (-)
Fire Alarm Strobes	Orange (+) and Blue (-)
Un-Interruptible 24 Volt Power (Annunciator, Water Flow, and Audible Device)	Yellow (+) and White (-) Note: A single white wire may be common to both
Interruptible 24 Volt Power (4 wire smoke detectors, duct detectors)	Brown (+) and White (-) Note: A single white wire may be common to both
Switch-Leg Sprinkler Bell (Between water flow and audible device)	Violet (+) and White (-)
Door Holding Magnets (Non Power Limited)	Black (+) and White (-)

3.03 FEEDER IDENTIFICATION

A. Feeder wires and cables shall be identified at each point the conduit run is broken by a cabinet, box, gutter, etc. Where terminal ends are available, identification shall be by means of heat shrink wire markers, which provide terminal strain relief. Markers shall be by Tyco Electronics, Panduit, Brady Perma-Sleeve, or equal. Identification in other areas shall be by means of wrap-around tape markers from Tyco Electronics, Panduit,

Brady Perma-Code or equal. Markers shall include feeder designation, size, and description.

3.04 TAPE AND SPLICE KITS

A. Splices, joints, and connectors joining conductors in dry and wet locations shall be covered with insulation equivalent to that provided on conductors. Free ends of conductors connected to energized sources shall be taped. Voids in irregular connectors shall be filled with insulating compound before taping. Thermoplastic insulating tape approved by UL, NRTL, or equal for installation as sole insulation of splices shall be furnished and shall be installed according to manufacturer's printed specifications.

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.06 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 26 0533

CONDUIT

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Addenda, Alternates, Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specifications collectively apply to work of this Section.

1.02 DESCRIPTION

A. Work includes but is not limited to the following:

1. Rigid metal conduit and fittings.
2. Intermediate metal conduit and fittings.
3. Electrical metallic tubing and fittings.
4. Flexible metal conduit and fittings.
5. Liquidtight flexible metal conduit and fittings.
6. Non-metallic conduit and fittings.

PART 2: PRODUCTS

2.01 RIGID STEEL CONDUIT AND FITTINGS

A. Rigid Steel Conduit: Hot dipped galvanized inside and out, galvanized threads, mild steel, zinc coated, inside and outside protective coating. Standard lengths: 10'-0".

B. Bushings: Threaded insulated metallic type except sizes 1" and smaller may be non-metallic type. Setscrew bushings are not acceptable.

C. Couplings, elbows, bends and other fittings: Same material and finish as rigid steel conduit. All shall be threaded type.

2.02 RIGID ALUMINUM CONDUIT AND FITTINGS

A. Conduit: Extruded from 6063-T24 alloy of maximum 1/10% copper content and containing lubricating inside liners; rigid threaded type.

B. Bushings: Insulated metallic except that sizes 1" and smaller may be non-metallic.

2.03 INTERMEDIATE METAL CONDUIT (IMC) AND FITTINGS

A. Conduit: Galvanized steel, zinc coated, protective coating inside and out.

B. Fittings and Conduit Bodies: Use fittings and conduit bodies specified above for rigid steel conduit.

C. Conduit: May be used in lieu of rigid steel conduit where permitted by code, except in concrete, underground, runs longer than 100 feet for all power feeders with conduit greater than 2 inches.

2.04 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

A. Conduit: Hot dipped galvanized or sherardized inside and out, zinc coated with protective enamel coating inside. Provide bushings at ends of conduits.

B. Connectors: Steel, insulated, bused tap-on or wrench tightened compression type. (Couplings similar) Indentor or screw type not acceptable.

C. Conduit: May be used in lieu of rigid steel conduit where permitted by code, except exposed, in concrete and for runs more than 100' for all power feeders with conduit greater than 2 inches.

2.05 FLEXIBLE METAL CONDUIT AND FITTINGS

A. Conduit: Steel single strip, hot dipped galvanized on all 4 sides prior to fabrication. Flexible aluminum conduit will not be allowed.

B. Connectors: Die cast with ridges that thread into conduit. (Binding screw type connectors are not acceptable.)

C. Conduit: May be used in lieu of rigid steel conduit where specifically indicated; at connections to vibrating equipment; at drops to light fixtures from J-boxes; at locations judged by Architect impractical to use rigid conduit. Maximum length for any application shall be 6 feet.

2.06 LIQUIDTIGHT FLEXIBLE CONDUIT AND FITTINGS

A. Conduit: Steel, single strip, hot dipped galvanized on 4 sides prior to fabrication.

B. Connectors: Insulated, special Appleton "STN" Series.

C. Jacket: Liquidtight, polyvinyl chloride plastic.

D. Conduit: Use for final connection to motor terminal boxes and transformers. Use at exterior locations, damp locations, wet locations and for flex connections in kitchen, restrooms and similar areas.

2.07 PLASTIC CONDUIT AND FITTINGS

A. Conduit: Extruded, virgin polyvinyl chloride compound, Schedule 40, heavy wall, in 10'-0" lengths with couplings.

B. Fittings: Non-threaded type couplings.

C. Conduit: May be used underground only. Vertical elbows and risers of all sizes shall be rigid steel with 20 mil bonded PVC coating.

2.08 CONDUIT SUPPORTS

A. Conduit Clamps, Straps, and Supports: Steel or malleable iron. Clamps: Unistrut Nos. P111 thru P1124, Kindorf No. C105. Straps: One or two hole as required.

B. Conduit hangers, racks and trapezes: Steel, threaded rods, channel iron "U" shaped racks equal to "Unistrut".

C. Individual conduit hangers: Steel, threaded rods with malleable iron split rings.

D. Hanger rods: 3/8" minimum diameter for 2" and smaller conduit, factory made. 1/2" minimum for 2-1/2" and larger conduit.

E. Wire supports: 12 gauge zinc coated iron tie wire, or 16 gauge galvanized double annealed steel tie wire.

2.09 CONDUIT ROOF JACKS AND FLASHING

A. Roof Jacks:

1. For Single Conduits Through Roof: Stonemen Stormtite Series #1100-4; seamless 4 pound lead flashing assembly, 8" skirt, steel reinforced varipitch boot; caulk type cast iron counterflashing sleeve, with vandalproof set screws, and Perma-seal waterproofing compound.

2. Sleeves for Conduits: Sleeves shall be adjustable type, of 26 gage galvanized iron, Adjust-to Crete Co. Adjust-to-Crete, or Jet Line Products Inc. Jet-Line, or equal.

3. Where conduit enters a building through a concrete foundation below grade, or ground water level, or where it is necessary to seal around a conduit where it passes through a concrete floor or wall, provide O-Z/Gedney Type FSK Thru Wall and Floor Seal, or equal.

2.10 CONDUIT PULLING CORDS

A. Pull Wire: No. 12 galvanized iron or nylon pull wire rated 250 pounds tensile strength.

2.11 CONDUIT FITTINGS, ELLS AND BUSHINGS

A. Special conduit fittings: Crouse-Hinds "Condulets" or Appleton "Unilets".

B. Ells: Same quality, same finish and same make as conduit.

C. Bushings: Thomas & Betts or approved equal.

D. Seismic separations and expansion joints: OZ type "AX" complete with bonding strap and clamps. At exterior locations use OZ type "EX".

2.12 CONDUIT SEALS AND SEALING COMPOUND

A. Vertical seals: Crouse Hinds type "EYD" or Appleton type "SF".

B. Horizontal Seals: Crouse Hinds type "EYS" or Appleton type "ESU".

C. Sealing compound: Crouse Hinds "CHICO" or Appleton "APELCO".

D. Fireproofing Compound: Dow Corning No. 3-6548 RTV or equal by 3M Company or Nelson.

2.13 UNDERGROUND SPACERS FOR PVC CONDUIT

A. Spacers: PVC, interlocking type, intermediate and base styles.

B. Sizes: For 2" to 4" conduit.

C. Manufacturer: Carlon or approved equal.

2.14 SPECIAL UNDERGROUND COUPLINGS FOR PVC CONDUIT

A. Expansion couplings: PVC type to expand up to 4".

B. Couplings: Socket type for joining PVC conduit.

C. Adapters: Socket type at one end for PVC conduit and threaded female type at other end for metallic connection.

2.15 PLASTIC CONDUIT CEMENT

A. Solvent weld cement: Fast drying, brush-on type.

2.16 MC CABLE

A. Metal Clad (MC) cable system is not allowed.

PART 3: EXECUTION

3.01 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

A. Arrange conduit to maintain headroom and present a neat appearance.

B. Unless indicated otherwise, conceal conduit within or behind finished walls and ceiling.

C. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.

D. Maintain minimum 6 inch clearance between conduit and piping. Maintain 12 inch clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.

E. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.

F. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.

G. Do not fasten conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.

H. Do not support conduit from any equipment subject to vibration. Support from structural members only.

I. Structural Considerations for Conduit Routing:

1. Where conduits are to pass through or will interfere with any Structural member, or where notching, boring or cutting of the structure is necessary, or where special openings are required through walls, floors, footings, or other

buildings elements, to accommodate the electrical work, such work shall conform to State Building Code.

2. Where conduits are terminated in groups at panelboards, switchboards and signal cabinets, etc., provide templates or spacers to hold conduits in proper position and to preserve alignment. Conduits terminating at signal cabinets shall enter cabinets in following approved locations only: Conduits entering top, side, and bottom of cabinets shall be aligned in a single row, centered 2" from rear of cabinet; conduits entering back of cabinet shall be aligned in a single row centered 2" from top of cabinet. Conduits shall not be spaced closer than 3" on centers.

3. 1" and smaller conduits above metal lath ceilings shall be tied to ceiling channels. 1-1/4" conduits above metal lath ceilings shall be rigidly suspended with pipe hangers or pipe racks or shall be secured to superstructure with factory made pipe straps. Conduits in metal lath or steel stud partitions, shall be tied to furring channels or studs. In ceiling spaces and in partitions, tie wires shall be spaced not more than 5'-0" apart, shall hold conduit tight against channels and studs at point of tie and shall not bear any of weight of conduit. Tie wire shall be #16 gage galvanized double annealed steel tie wire.

4. Where auxiliary supports, saddles, brackets,, etc., are required to meet special conditions they shall be made rigid and secure before conduit is attached thereto.

5. Conduit in ceiling spaces, in stud walls and under floors shall be supported with factory made pipe straps or shall be suspended with pipe hangers or pipe racks. Pipe straps shall be attached to and shall hold conduit tight at point of support against ceiling and floor joists, rafters, and wall studs, or 2" x 4" headers fitted between joists or wall studs.

6. Conduits installed on exposed steel trusses and rafters shall be fastened with factory made conduit straps or clamps which shall hold conduit tight against supporting member at point of support.

7. Conduits under buildings shall be strapped with factory made conduit straps to underside of concrete floor or joists, or wood floor joists, or shall be suspended with pipe hangers or pipe racks. Conduits under building shall not rest on ground but shall be suspended from building or shall be buried below surface of ground. 1" and larger conduits under buildings shall be suspended with conduit hangers or racks.

8. Pipe hangers for individual conduits shall be factory made, consisting of a pipe ring and threaded suspension rod. Pipe ring shall be malleable iron, split and hinged, and shall securely hold conduit, or shall be springable wrought

steel. Rings shall be bolted to or interlocked with suspension rod socket. Rods shall be 3/8" for 2" conduit hangers and smaller and shall be 1/2" for 2-1/2" conduit hangers and larger.

9. Pipe racks for groups of parallel conduits and for supporting total weights not exceeding 500 pounds shall be trapezed type and shall consist of a cross channel, Steel City Kindorf #B-900, Unistrut #P-1000 suspended with a 3/8" minimum diameter steel rod at each end. Each rod shall be fastened with nuts, top and bottom to cross channel and with a square washer on top of channel. Each conduit shall be clamped to top for cross channel with conduit clamps, Steel City Kindorf #C-105 or Unistrut Nos. P-1111 through P-1124. Conduits shall not be stacked one on top of another, but a maximum of 2 tiers maybe on same rack providing an additional cross channel is installed. Where a pipe rack is to be longer than 18", or if weight it is to support exceeds 500 pounds, submit details of installation to the Architect for approval.

10. Factory-made pipe straps shall be one or 2-hole formed galvanized clamps, heavy duty type, except where otherwise specified.

11. Hangers straps, rods, or pipe supports under concrete shall be attached to inserts set at time concrete is poured. Under wood use bolts, lag bolts, or lag screws; under steel joists or trusses use beam clamps.

3.02 CONDUIT INSTALLATION

A. Cut conduit square using a saw or pipe cutter; de-burr cut ends.

B. Bring conduit to the shoulder of fittings and couplings and fasten securely.

C. Use conduit hubs or sealing locknuts for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations.

D. Install no more than equivalent of two 90- degree bends between boxes for conduits 2" diameter and larger, three for conduit under 2" diameter. Locate pull boxes as required.

E. Use conduit bodies to make sharp changes in direction, as around beams.

F. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inch size.

G. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.

H. Support rigid, intermediate and thin wall conduit at 8'-0" maximum on centers and 3'-0" from junction boxes.

I. Support flexible and liquidtight flexible conduit at 4'-0" maximum on centers and 12" from junction boxes.

J. PVC conduit: Use underground only. Encase in 3" concrete (2000 psi) envelope except under building.

K. Provide No. 12 AWG insulated conductor or suitable pull string in empty conduit, except sleeves and nipples.

L. Install expansion-deflection joints where conduit crosses building expansion or seismic joints.

M. Where conduit penetrates fire-rated walls and floors, seal opening around conduit with UL listed fire barrier, "3M" calk or equal.

N. Route conduit to roof mounted devices and equipment through roof jacks. Provide flashing/roof jacks for all new and existing conduits which penetrate roof to appropriate Roofing Section(s) for installation.

O. Run conduit to equipment on roof concealed in attic space. Penetrate roof at equipment locations only.

P. For conduits to roof mounted HVAC equipment, penetrate roof with roof jacks outside footprint of HVAC units. Do not penetrate roof inside HVAC units.

Q. Do not use aluminum conduit below grade, cast in concrete or in masonry in contact with earth.

R. Conduit underground may be rigid conduit and in these conditions shall be given two heavy coatings of a suitable primer and a single half lapped layer of protective plastic tape. Primer and tape shall be "Scotchrap" No. 50 tape. Primer and tape shall be "Scotchrap" Primer or Trantex V-10 tape and Dutch Brand Primer. Primer and tape shall be in strict accordance with manufacturer's instructions. As an alternate, conduit and fittings shall have a PVC bonded coating (40 mil thickness minimum) by Occidental Coating Company.

S. Where conduit is installed underground, under slabs on grade, exposed to weather or in wet locations, make joints liquidtight and gastight.

T. For underground or underslab conduit, apply a heavy coat of Pabco P & B No. 2 paint to all surfaces within 6" each side of fittings and to areas where wrenches or other tools have been applied. On exposed conduit, repair scratches and other defects with galvanizing repair stick, Enterprise Galvanizing "Galvabar".

U. Cut threads on rigid conduit to standard taper and to a length such that all bare metal exposed by threading operation will be completely covered by couplings or fittings used. In addition, cut lengths of thread such that all joints will become secure and wrench tight just preceding point where conduit ends would butt together in couplings and where conduit ends would butt into ends or shoulders of other fittings. Securely tighten all threaded connections.

V. Encase all underground primary and secondary electric service conduits in concrete envelopes with a minimum 3" cover all around from end-to-end. Provide concrete with a compressive strength of not less than 2,000 psi at 28 days of age. Provide red concrete encasement for systems over 600-volt. Space multiple conduit not less than 3" apart. Use factory made conduits spacers to stagger connections or couplings for neater installation. Tie conduit to spacers and anchor system to prevent dislodgement. Provide personnel to inspect during pouring to prevent displacement of conduit.

W. Make joints in rigid conduit installed in concrete or masonry liquid-and-gas-tight, with red lead and oil, or other approved joint compound and engage not less than five threads.

X. Keep bends and offsets in conduit runs to an absolute minimum. Replace all deformed, flattened or kinked conduit. Provide large radius factory made bends or power bend rigid metal conduit of 1-1/4" trade size or larger.

Y. Place sleeves for electrical conduit passing through walls, beams or slabs before concrete is poured (exception-floor slabs on earth). Where conduit passes through suspended floor slabs, outside of chases, sleeves shall be standard weight black steel pipe extending 1-1/2" above the finished floor level. Sleeves at other locations shall be either lightweight galvanized steel tube, or galvanized sheet steel, with a minimum thickness of 24 USSG. Clearance between conduit and sleeves shall be not less than 1/2". Sleeves through outside walls below grade shall be caulked tight. Caulk with oakum and mastic to obtain watertight joint.

Z. Penetration Membrane: Where penetration cannot be avoided, cut and re-seal membrane at point of penetration.

AA. Provide minimum 3/4" conduit size underground.

BB. Run exposed conduit parallel with or at right angles to building line, beams, or ceilings. Place symmetrical bends or metal boxes at changes in direction or taps.

CC. Stub from each panel which is flush mounted in a wall, from top of panel a minimum of 3-3/4" conduits to nearest ceiling space or other accessible locations and cap for future use. Tag to indicate panel origination.

DD. Independently support conduit rising from floor for motor connections if over 24" above floor. Support shall not be a motor or duct work which may transmit vibrations.

EE. Provide pull wire in all conduit runs indicated as conduit only (C.O.).

FF. Do not run conduit closer than 12" to any hot water pipe, steam pipe, heater flue or vent.

GG. Terminate conduit stub-ups through floor for connection to equipment of junction boxes in couplings flush with top of concrete slab floor.

HH. Within building, bury underground conduit a minimum of 6" below bottom of slab.

II. Use rigid metal conduit where legally required, where exposed to weather, where located in unheated areas, or where subject to mechanical injury, here defined as exposed conduit less than 7'-6" above floor in areas accessible to anyone other than authorized operating or maintenance personnel.

JJ. Where a conduit from one structure crosses to another structure, e.g., from a building to an arcade or from one arcade to another arcade, use a section of liquid-tight flex conduit at the crossing with sufficient slack to allow the two structures to move during an earthquake without breaking the conduit. For stub up to relocatable buildings, provide liquid-tite flex from stub up to first box on back of building.

KK. Provide PVC deflection - expansion joint fittings where underground run passes through expansion joint or is necessary for seismic conditions.

LL. Provide a green insulated ground wire in all flexible conduit runs regardless of length.

MM. Wipe plastic conduit (PVC) clean before joining. Apply even coat of cement to entire area to be inserted into fitting. Let joint cure for 20 minutes minimum. Use approved solvent-weld cement specifically manufactured for purpose. Threading of PVC conduit is prohibited.

NN. Install an equipment ground (green) insulated conductor in each non-metallic conduit.

OO. Do not install PVC conduit above grade for any reason. Seal both ends of all PVC conduit runs at each junction box or conduit interruption with sealant. Seal steel conduit risers to panelboards, switchboards, or pullboxes from underground PVC conduit runs.

PP. Flash and counterflash all conduit runs passing through roof.

QQ. Use electrical metallic tubing above grade in dry locations only and where not subject to mechanical injury or otherwise prohibited. Concrete and masonry in contact with earth are not considered dry locations.

RR. Use liquid tight flexible conduit for final connections to motors and vibrating equipment. Use flexible conduit where required for equipment servicing for connections to recessed lighting fixtures from nearby accessible junction boxes, and for concealed runs in dry locations where structural conditions prevent use of other types of conduit.

SS. For conduits for computer cables and coax cables, use large radius bends. Do not use j-box or pull box to change direction. Install boxes at straight conduit sections only and sweep conduit to make turns. Do not use condulet fittings to change directions.

TT. Minimum radius for conduits designated for computer LAN wiring, coax cable wiring, data wiring, fibre-optics wiring, and TV cable wiring shall be as follows:

3/4"C	-	12"
1"C	-	12"
1-1/4"C	-	18"
2"C	-	24"
2-1/2"C	-	24"
3"C	-	30"
3-1/2"C	-	30"
4"C	-	30"
5"C	-	36"
6"C	-	42"

UU. Size all conduits as legally required or larger where indicated or preferred. Where portions of a conduit run are increased in size, for whatever reason, make all remaining portions in that run same size.

VV. Mark all underground conduit stub-outs with a 6 inch square by 2 foot deep concrete block with an embedded brass nameplate indicating the origin of conduit.

WW. Do not cut concrete, masonry or structural members except where approved by Architect.

XX. Underground Requirements:

1. Except for branch circuit conduits and auxiliary system branch circuits within a building, all conduits installed underground shall be entirely encased in concrete (2000 psi), 3" thick on all sides with multiple conduits spaced not less than 3" apart, except where otherwise specified. Provide approved conduit spacers as required to prevent any deflection of conduits when concrete is placed and to preserve position and alignment of conduits in

concrete. Conduits shall be tied to spacers. Anchors shall be installed to prevent floating of conduits during pouring of concrete. Red concrete shall be used to encase conduits of systems operating above 600 volts. To protect conduits from underground to surface wall mounted panels, terminal cabinets, etc., encase conduits in 3" high concrete curb.

2. Assemble sections of conduit with approved fittings and stagger all joints. Cut ends of conduit shall be reamed to remove all rough edges. Joints in all conduits shall be made liquid-tight. All bends at risers shall be completely below surface where possible.

3. Two or more conduit runs in a common trench shall be separated by at least 3" of concrete. Conduit runs installed in a common trench with other utility lines and water, gas, sew lines, shall be separated from such lines by at least 12" horizontally. Power conduits shall be separated from low voltage signal conduits by 6" of concrete.

4. Slope underground conduits between two pull boxes towards one of the boxes to avoid water and moisture trap. For underground conduits coming out of a building, slope conduits towards the first pull boxes. Take care to install underground conduits such that water cannot travel through underground pull boxes and conduits back into a building. Prevention method shall include but not limited to installing pull boxes with draining provision where conduits enter building, sealing both ends of each conduit water tight, etc.

5. Provide electronic markers to identify conduit stub locations at property lines, as required by electric service utility company.

6. All underground conduit systems for use by service utility company shall meet all requirements of utility company.

3.03 EXCAVATION AND BACKFILL

A. Include all excavation and backfilling required for work under this Section.

1. Bury underground conduit at least 27 inches below finished grade to top of conduit encasement.

2. Underground branch circuit conduit, within building limits, 6" below bottom of slab unless specifically indicated otherwise in these specifications.

3. After installation of work has been inspected and approved, backfill trenches with clean earth, moistened and layer tamped to same compaction density as specified for both building and site locations under "Earthwork".

B. Locate existing underground pipes by use of electronic locating devices and exercise utmost care in excavation work. Contractor is responsible for satisfactory repair of any underground utility line damaged as result of his excavation.

C. Trenches or any other excavation required for installation of electrical work, which are outside of barricaded working area, shall be barricaded at all times with continuous portable barricades. At completion of work, remove barricades from site. Backfill trenches and excavations outside of barricaded working area immediately after approval of conduit work by Inspector.

D. Where asphalt concrete has been cut, backfill up to existing grade.

E. Do not start excavations until approval is obtained from Inspector.

END OF SECTION

SECTION 26 0534

BOXES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Addenda, Alternates, Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specifications collectively apply to work of this Section.

1.02 DESCRIPTION

A. Work includes but is not limited to the following:

1. Wall and ceiling outlet boxes.
2. Floor boxes.
3. Pull and junction boxes.
4. Sealant.

B. Related Work:

1. Section 260100 - Basic Materials and Methods.
2. Section 260533 - Conduit
3. Section 262726 - Wiring Devices.

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS-OUTLET BOXES

A. Raco

B. Steel City

C. Bowers

2.02 OUTLET BOXES

A. Sheet Metal Outlet Boxes: One piece galvanized, pressed steel, knockout type, 4-11/16" sq. by 2-1/8" deep in all locations unless otherwise indicated or required.

B. Cast Boxes: Aluminum, or Cast feralloy, deep type, gasketed cover, threaded hubs.

C. Where Wiremold type box have to be used, e.g., on existing concrete wall, provide proper box such that the total depth of a box including the device mounted on the box, will not exceed 4 inches.

2.03 ACCEPTABLE MANUFACTURERS-FLOOR BOXES

A. Hubbell

B. Walker Parkersburg

C. Steel City

2.04 FLOOR BOXES

A. Floor Boxes: Fully adjustable, cast iron boxes, Hubbell B4200 and B4300 Series with metal carpet flanges and metal flap covers.

2.05 PULL AND JUNCTION BOXES

A. Interior and non-weatherproof boxes shall be constructed of blue or galvanized steel with ample laps, spot welded, and shall be rigid under torsional and deflecting forces. Boxes shall have auxiliary angle iron framing where necessary to ensure rigidity. Covers shall be fastened to box with a sufficient number of brass machine screws to ensure continuous contact all around. Flush type boxes shall be drilled and tapped for cover screws at Site if boxes are not installed plumb. All surfaces of pull and junction boxes and covers shall be given one coat of metal primer, and one coat of aluminum paint.

B. Weatherproof pull and junction boxes shall conform to foregoing for interior boxes with following modifications: Cover of flush mounting boxes shall have a weather-tight gasket cemented to and trimmed even with cover all around. Surface or semi-flush mounting pull and junction boxes shall be UL approved as rain-tight and shall be complete with threaded conduit hubs. All exposed portions of boxes shall be galvanized and finished with a prime coat and coat of baked-on gray enamel.

C. All junction and pull-boxes shall be rigidly fastened to the structure and shall not depend on conduits for support.

D. Cast Metal Boxes for Outdoor and Wet Location Installations: Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as rain-tight. Galvanized cast

iron OR Cast aluminum box and cover with ground flange, neoprene gasket, and stainless steel cover screws.

2.06 ACCEPTABLE MANUFACTURERS-SEALANT

A. Crouse Hinds "CHICO"

B. Permacel

C. Ductseal

2.07 ACCEPTABLE MANUFACTURERS - FIRE PROOFING SEALANT

A. Dow Corning

B. 3M Company

C. Nelson

PART 3: EXECUTION

3.01 COORDINATION OF BOX LOCATIONS

A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.

B. Electrical box locations shown on Contract Drawings are approximate unless dimensioned. Verify exact location of floor boxes and outlets in offices and work areas with Owner's representative prior to rough-in.

C. Locate and install boxes to allow access.

D. Locate and install to maintain headroom and to present a neat appearance.

3.02 OUTLET BOX INSTALLATION

A. Unless otherwise noted on plan or specifically allowed by the Engineer, conceal all boxes flush in wall or in ceiling space above drop ceiling. In finished areas and where it is not possible to conceal conduits and boxes, for example, on existing concrete wall, provide Wiremold type metallic surface raceways and boxes.

B. Do not install boxes back-to-back in walls. Provide minimum 6 inch separation, except provide minimum 24 inch separation in acoustic-rated walls.

C. Provide knockout closures for unused openings.

D. Support boxes independently of conduit except for cast box that is connected to two rigid metal conduits, both supported within 12 inches of box.

E. Use multiple-gang boxes where more than one device are mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

F. Install boxes in walls without damaging wall insulation.

G. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

H. Position outlets to locate lighting fixtures as shown on reflected ceiling plans.

I. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed lighting fixture, to be accessible through lighting fixture ceiling opening.

J. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs. Accurately position to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes. Install plaster rings to interface with equipment to be mounted thereon.

K. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

L. Provide cast outlet boxes in exterior locations and wet locations. Provide cast bell-boxes at interior locations where box is exposed to view. (do not use regular 4/s or handy box with exposed knockouts and unfinished appearances for these interior exposed applications).

M. Where boxes are installed in fire rated ceiling or walls, be responsible for preserving integrity of fire rating as required.

N. In fire-rated wall, use 4" square deep boxes. Do not aggregate more than 100 square inches of boxes for any 100 square feet of wall or partitions. Separate outlet boxes on opposite sides of walls or partition by a minimum horizontal distance of 24 inches. Where the separation cannot be achieved due to site condition, provide 2-hour rated fire-proof material behind boxes to maintain fire rating of walls.

3.03 FLOOR BOX INSTALLATION

A. Set boxes level and flush with finished concrete floor.

B. Use cast iron floor boxes for installations in slab on grade.

C. During pouring of floor slab sections, take proper steps to prevent flush floor outlets from being displaced from exact required locations and finished flush positions.

3.04 PULL AND JUNCTION BOX INSTALLATION

A. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.

B. Support pull and junction boxes independent of conduit.

END OF SECTION

SECTION 26 0553

ELECTRICAL IDENTIFICATION

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Addenda, Alternates, Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specifications collectively apply to work of this Section.

1.02 DESCRIPTION

A. Work includes but is not limited to the following:

1. Nameplates.

a Wire and cable markers.

B. Related Work:

1. Section 260100 - Basic Materials and Methods.
2. Section 260519 - Wire and Cable -Rated 600 Volt.
3. Section 260526 - Grounding.
4. Section 260533 - Conduit.
5. Section 260534 - Boxes.
6. Section 262416 - Panelboards.
7. Section 262816 - Disconnect Switches.
8. Auxiliary System Sections.

PART 2: PRODUCTS

2.01 MATERIALS

A. Nameplates: Engraved three-layer laminated plastic, white letters on a black background.

B. Wire Markers: Cloth markers, split sleeve or tubing type.

PART 3: EXECUTION

3.01 INSTALLATION

A. Degrease and clean surfaces to receive nameplates.

B. Install nameplates parallel to equipment lines.

C. Secure nameplates to equipment fronts using screws or rivets. Secure nameplate to outside face of panelboard doors.

D. Embossed tape will not be permitted for any application.

3.02 WIRE IDENTIFICATION

A. Provide wire markers on each conductor in panelboard gutters, pull boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.

3.03 NAMEPLATE ENGRAVING SCHEDULE

A. Provide nameplates of minimum letter height as scheduled below.

B. Panelboards, Switchboards, and Distribution Sections: 1/4 inch identifying equipment designation; 1/8 inch identifying voltage rating and source. Provide nameplates on load centers furnished with relocatable buildings. Nameplates for relocatable buildings shall match description on circuit breakers or switches at switchboards or panelboards feeding the buildings.

C. Individual Circuit Breakers, Switches, Motor Starters in Panelboards, and Distribution Sections: 1/8 inch identifying circuit and load served, including location.

D. Individual Circuit Breakers, fused and non-fused disconnect Switches, and Motor Starters: 1/8 inch identifying load served.

E. Exterior metal pull boxes: 1/4 inch identifying systems in boxes.

F. Terminal Cabinets: 1/4 inch identifying systems.

3.04 MARK CONDUCTOR RUNS

A. Apply markers after conductors installed in conduits.

B. Apply in panelboards and in junction boxes.

C. Mark feeders in panelboards, switchboards and distribution sections.

3.05 MARK JUNCTION BOXES

A. Mark covers of junction boxes with non-erasable marker to indicate circuit numbers or systems contained within boxes.

B. Mark fire alarm boxes with red marker and identifying as "FA".

C. Paint fire alarm conduits red at intervals such that conduits can be clearly identified for fire alarm system.

END OF SECTION

SECTION 26 2726

WIRING DEVICES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Addenda, Alternates, Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specifications collectively apply to work of this Section.

1.02 DESCRIPTION

A. Work includes but is not limited to the following:

1. Wall Switches
2. Receptacles.
3. Device plates and box covers.

B. Related Work:

1. Section 260100 - Basic Materials and Methods.
2. Section 260526 - Grounding.
3. Section 260534 - Boxes.
4. Section 260553 - Electrical Identification.

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS – WALL SWITCHES

A. Harvey Hubbell Company.

B. Pass and Seymour.

C. Leviton.

2.02 WALL SWITCHES

A. Wall switches for Lighting Circuit AC general use snap switch with toggle handle, rated 20 amperes and 120/277 volts AC. Handle: White or color as selected by Architect, plastic. Decorator spec grade.

2.03 ACCEPTABLE MANUFACTURERS - RECEPTACLES

A. Harvey Hubbell Company.

B. Pass and Seymour.

C. Leviton.

2.04 RECEPTACLES

A. Convenience and Straight-blade Receptacles: NEMA Configuration 5-15R: Decorator Spec Grade, White.

B. Convenience and Straight-Blade Receptacles: NEMA configuration 5-20R: Decorator Spec Grade, White.

C. Convenience receptacle, isolated ground type, orange in color: Decorator Spec Grade.

D. GFI Receptacles: Duplex convenience receptacle with integral ground fault current interrupter, NEMA 5-20R, Decorator Spec Grade, White. Unit shall comply with UL 2003 GFCI requirements including lockout action.

E. Receptacles: Highest specification grade.

F. Provide tamper-resistant receptacles with thermoplastic dual mechanism shutter system to help prevent insertion of foreign objects. Receptacles shall have extra heavy-duty brass, one-piece mounting strap with integral ground. Receptacles shall be white color, impact resistant nylon face and back body. For tamper-resistant receptacles rated 20 amps/125 volts, provide NEMA 5-20R, white in color. For tamper-resistant receptacles rated 15 amps/125 volts, provide NEMA 5-15R, white in color. Provide Decorator Spec Grade receptacles.

G. Split wired half controlled receptacle: NEMA 5-20R, 20 amp, Pass & Seymour 26352CH-W or equal.

2.05 ACCEPTABLE MANUFACTURERS - WALL PLATES (Match manufacturer of Device)

A. Harvey Hubbell Company.

B. Pass and Seymour.

C. Leviton.

D. TayMac.

E. Match manufacturer of switches and receptacles.

2.06 WALL PLATES

A. Interior Device Plates: Sierra Electric .040 stainless steel to suit device; multi-gang where required; blank plates at junction boxes and capped outlets.

B. Weatherproof Cover Plates: Receptacles in wet locations shall be installed with an outlet enclosure clearly marked “Suitable for Wet Locations While In Use”. There must be a gasket between the enclosure and the mounting surface, and between the cover and base to assure a proper seal. The enclosure must employ stainless steel mounting hardware and enclosure shall be recessed where possible and by TayMac Corporation or equal.

C. Highest specification grade.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install wall switches 48 inches above floor to top of wall box, “OFF” position down. Verify mounting height with Architect prior to installation.

B. Install convenience receptacles 18 inches above floor, or as noted on drawings, grounding pole on bottom.

C. Install specific-use receptacles at heights shown on Contract Drawings.

D. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets in non-public places.

E. Install devices and wall plates flush and level.

F. Provide etched plates with 3/16” high black letters for:

1. Outlets where voltage is other than 120 volt.

2. When switch controls device other than lighting fixture.

3. When switch is located out of sight of unit being controlled.

4. Lock switches.

5. Where more than one switch occurs under a common plate.

6. Air Distribution System control switches.

G. Install plates with all four edges in continuous contact with finished wall surfaces without use of mats or similar devices.

H. Provide blank cover plates for all boxes as required.

END OF SECTION

SECTION 26 5100

LIGHTING FIXTURES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Addenda, Alternates, Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specifications collectively apply to work of this Section.

1.02 DESCRIPTION

A. Work includes but is not limited to the following:

1. Lighting fixtures and accessories.

2. Lamps.

B. Related Work:

1. Section 260100 - Basic Materials and Methods.

2. Section 260519 - Wire and Cable.

3. Section 260526 - Grounding.

4. Section 260533 - Conduit.

5. Section 260534 - Boxes.

1.03 SUBMITTALS

A. Submit Shop Drawings.

B. Include outline drawings, lamp and ballast data, support points, weights, and accessory information for each lighting fixture type.

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS - LIGHTING FIXTURES

A. See Lighting Fixture Schedule on drawings.

2.02 SWITCHING AND DIMMING CONTROLS

A. General

1. All devices color per architect.

2. Observe manufacturers installation instructions with particular attention to derating requirements for multiple gang installations.

3. Use factory made multiple gang faceplates matching device color.

4. Daylight Controls may be integrated into luminaires Performance shall equal or exceed specification for individual devices.

B. Switches

1. Standard snap style

2. 120/277 volt, 20A

3. Listed

4. Specification grade

5. Color per architect

C. Automatic control switch

1. Automatic control switch shall be a push button wall switch capable of on/off manual operation and shall also be capable of receiving automatic control signals through interrupting power to the switch and load.

2. Control switch shall mount in a standard single gang or multi-gang wall box and shall fit behind a decorator style face plate.

3. Control switch shall use an air gap relay rated for 15 Amp ballast, tungsten, general use and shall be compatible with all electronic ballasts and HID loads.

4. The control switch when used with an occupancy sensor shall provide manual on/off control from the push button and automatic shut off based on occupancy. When occupancy is not detected and the sensor's time delay has expired, the lights shall turn off. If occupancy is detected within 15 seconds

of this shut off, the switch shall turn the lights back on. Otherwise, lights will remain off until the switch is manually turned on.

5. Control switch shall be capable of 3-way, 4-way, or multi-way switching.

6. Control switch shall be The Watt Shopper AS-100 or Sentry Switch or approved equal.

D. Motion sensors

1. Provide a dual technology sensor that detects presence in the control area by detecting Doppler shifts in transmitted ultrasound and passive infrared heat changes. Detection verification of both technologies must occur in order to activate lighting systems. Upon verification, detection by either shall hold lighting on.

2. Sensor shall have a retrigger feature in which detection by either technology shall retrigger the lighting system on within 5 seconds of being switched off.

3. Sensor shall be mounted and adjusted in order to eliminate detection through open doorways and outside of controlled area. To provide small motion diction and immediate activation upon entry, coverage of both technologies must be complete and overlapping throughout the controlled area.

4. The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens. The lens shall be Poly IR4 material. The lens shall cover up to 2000 square feet for walking motion when mounted at 10 feet and 1000 square feet of desktop motion.

5. Ceiling or high wall mounted. Coordinate location for best detection when used with suspended lighting.

6. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall automatically adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.

7. Sensors shall have a time delay that is adjusted automatically or shall have a fixed time delay of 5 to 30 minutes, set by DIP switches.

E. Automatic daylighting switches

1. Provide an ON/OFF daylight controller to reduce the controlled lighting as the daylight level increases. Where two stages of reduction are specified, provide a two stage controller providing a sequence reduction. As an alternate, two single stage controllers may be provided to provide two stages of reduction as long as these two devices may be adjusted to provide the

desired sequencing of the lighting reduction and maintain this sequencing when switching the lights off and again when switching the lights on.

2. Ceiling mounted or luminaire mounted. The function of the automatic daylighting switches shall not be provided by a wall switch or a device mounted at wall switch height. If the device s powered by line voltage then it must be enclosed in an enclosure rated a minimum of NEMA 1 with a tamper proof cover or locking cover.

3. Independently adjustable setpoint and deadband. Setpoint shall be adjustable from at least 10 footcandles up to100 footcandles. Deadband shall be adjustable up to at least 100% setpoint.

4. Adjustable time delay. Lighting level must be above the off setpoint continuously for the length of the time delay before the lights will switch off. The device shall not have a length of the time delay shorter than 3 minutes. Time delay shall be adjustable to up to 20 minutes.

5. Low voltage device to be connected by low voltage wiring to a power pack. If control sequence can be met, one power pack may be used with multiple control devices.

6. Daylight switch shall provide visible indicator of the current status of the control output. Indicator shall be an LED.

7. Daylight switch to provide a test mode that temporarily bypasses the time delays. If left in test mode, the daylight switch will automatically resume normal time delays at the end of a period no longer than 60 minutes. (This item is a requirement of the 2005 Title 24 standard).

F. Automatic daylighting dimming systems

1. Provide a daylighting controller to continuously dim the fluorescent lights. Daylighting controller may be a self contained photosensor or a controller with a remote photocell. Photocell or photosensor are to be ceiling mounted or attached to a pendant fixture.

2. Photosensor to provide 0 – 10 V dimming signal to continuously dim the ballasts proprietary methods of signaling dimming ballasts shall be acceptable.

3. Daylighting controller may be open or closed loop type. Closed loop devices may not be used in applications where there are adjoining dimming zones such that the luminaires from one dimming zone can be viewed by the daylighting controls in another zone. All daylighting controllers shall provide proportional control. An open loop device may accomplish this with

one adjustment. All closed loop devices shall have at least two adjustments to provide an adjustable response. Any device which attempts to maintain a constant photocell signal shall not be acceptable.

4. All adjustments shall be adjustable from the photocell.

5. Provide an occupant adjustment or override wall switch to allow the teacher to adjust the light levels.

6. Approved sensor/control manufacturers: Wattstopper, Lutron, Leviton, Lithonia, Novitas, Douglas.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install lamps in lighting fixtures and lampholders.

B. Support surface-mounted lighting fixtures directly from building structure. Provide additional blocking, unistruts, steel channels, etc. as required.

C. Install recessed lighting fixtures with attached accessible junctions boxes to permit removal and access from below. Use plaster frames in plaster , gypsum wallboard or acoustic ceilings. In grid ceiling rated for light fixture support, support recessed fluorescent light fixtures directly from T-bar using approved earthquake clips and in addition, 2 No. 12 wires (slack wires), one at each diagonal end of fixture attached directly to a structural member. If two opposite ends of a fixture do not rest on ceiling main runners, provide 4 No. 12 wires (support wires) to structural member. In grid ceiling not rated for fixture support, attach fixture to grid using approved earthquake clips and in addition 4 No. 12 support wires directly to structural member.

D. Provide safety chain between fixture and structure for recessed light fixtures. Mount hanger channels to span structural and/or T-bar ceilings.

E. Provide required backing for all lighting fixtures.

F. Join continuously mounted fixtures by use of chase nipples.

G. Provide spacers where required.

H. Mount light fixtures so that fixture labels are not visible when viewed from below.

I. For recessed fixtures in fire rated ceiling, provide fireproofing enclosure equal to rating of ceiling.

J. Mount Parking Lot Poles complete with luminaires and lamps on concrete base.

K. In each pendant of a pendant mounted light fixture, provide a safety wire or cable attached to the fixture and structure at each support capable of supporting four times the supported load. Provide swivel mounts at ceiling and longitudinal sway mounts at fixtures to allow fixtures to swing freely a minimum of 45 degrees from vertical.

L. Test motion sensors and daylighting controls.

M. For all dimming systems, contractor is responsible for burning in all lamps for 100 hours. Lamps are to operate at full output for this period.

N. Contractor is responsible for setting up and adjusting all control devices per the manufacturer's adjustments and resulting performance.

3.02 TESTS

A. Immediately before turning completed job over to Owner, clean all light fixtures inside and out, including plastics and glassware, adjust and tighten all trim, replace broken or damaged parts, lamp and test fixtures for electrical and mechanical operation. Replace all inoperative lamps, ballasts and other inoperative equipment.

B. Replace noisy ballasts immediately.

C. Include in bid the service of a California Registered Professional Engineer or a Professional recognized by the State of California to review and certify the final installed lighting control system as required by the California Energy Code (Title-24). The Professional shall sign the required documents, submit to the proper agency and be responsible for certifying the installed lighting control system.

END OF SECTION

SECTION 27 1100

COMPUTER NETWORKING WIRING SYSTEM

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Addenda, Alternates, Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specifications collectively apply to work of this Section.

1.02 DESCRIPTION

A. Provide a complete Cable & Wiring Telecommunications Infrastructure. Provide equipment, materials and labor to render the cabling systems complete and operable for all outlet locations of the buildings, as specified within this document. This Project will use Category 6 wires, therefore, any reference of "Category 5e or Category 6" shall mean Category 6.

B. Principal items of work shall include but not be limited to:

1. Category 5e or Category 6 Data outlets.

2. Category 5e or Category 6 cables.

3. Cable management support rings in accessible ceiling space and conduits in inaccessible ceiling space.

4. Category 5e or Category 6 patch panel.

1.03 CODES AND STANDARDS

A. Comply with current versions of the following applicable codes and standards:

1. Underwriters Laboratories Inc. (UL): Applicable listings and ratings

2. California Electrical Code, current enforced edition

3. National, State, and Local Occupational Safety and Health Administration (OSHA) building and fire codes

4. ANSI/TIA/EIA-568-B, Commercial Building Telecommunications Cabling Standard

5. ANSI/TIA/EIA-569-A, Commercial Building Standard for Telecommunications Pathways and Spaces

6. ANSI/TIA/EIA-606-A, Administration Standard for Commercial Telecommunications Infrastructure

7. ANSI/TIA/EIA-607-A, Commercial Building Grounding and Bonding Requirements for Telecommunications, current issue

8. NFPA 70,National Electric Code, 2005 or current enforced addition

9. Institute of Electrical and Electronic Engineers (IEEE) 802.3 (Ethernet), 802.3u (100BaseTX/FX), 802.3Z (Gigabit Ethernet over optical fiber), 802.3ab (Gigabit Ethernet over 4 pair category 5 or higher), 802.11 (Wireless LAN)

10. Institute of Electrical and Electronic Engineers (IEEE) 802.1d (spanning tree protocol), 802.1p (QOS), 802.1q (VLAN tagging), 802.1x (Port Based Network Access Control)

11. National Electrical Manufacturer's Association (NEMA)

12. National Fire Protection Association (NFPA), NFPA-70

13. CCR Part 3 - California Electrical Code

14. CCR Part 2 - Uniform Building Code

15. ANSI, ASTM, UL, NEMA, IEEE and FCC standards as applicable.

16. The terms MC and MDF are used interchangeably.

17. The terms IC and IDF are used interchangeably.

1.04 SYSTEM DESCRIPTION

A. System Topology

1. The Backbone Topology shall be the Star Topology with the MC at the center of the star. The backbone cabling and pathway shall include multi-mode fiber optic cabling, connectors, patch cords, panels, ferrules, and enclosures required to provide the specified connectivity between the MC, ICs and the TRs.

2. The Horizontal Topology shall be the Star Topology and shall consist of Category 5e or Category 6, 100 Ohm Unshielded Twisted Pair (UTP) cables from TR's to data outlets. The horizontal cabling and pathway shall include Category 5e or Category 6 cabling from outlets to TRs and patch panels, wire management panels, vertical distribution rings, patch cords, and other miscellaneous items required to extend connectivity from IDFs to outlets. In the user areas, each Category 5e or Category 6 horizontal cabling drop outlet shall be terminated per TIA/EIA-568A, T568B.

3. There shall be one dedicated 6-strand multimode fiber optic cable from each IC to the MC.

4. Locations of MC and IC's are generally as shown on the drawings. Final locations must be verified in the field to suit the actual field condition and approved by the District during construction.

1.05 SUBMITTALS

A. Furnish catalog cuts, technical data and descriptive literature on components. Data shall be clearly marked and noted to identify specific ranges, model numbers, sizes and other pertinent data.

B. Shop drawings shall indicate wiring and schematics, details, panel configurations, sizes and a point-to-point wiring diagram of all circuits. Shop drawings shall indicate interfaces to equipment furnished by others, identifying numbers of wires, termination requirements, voltages and other pertinent details. Responsibility for each end of interfaces shall be noted on shop drawings.

C. Entire system shall be supported by engineering documentation including:

1. Riser diagrams indicating all devices, cabinets and their point-to-point connections.

D. Operating and Servicing Manuals:

1. Deliver required copies of "Operating and Servicing Manual" for each system. Each manual shall be bound in a flexible binder and data shall be typewritten or drafted.

2. Each manual shall include instructions necessary for proper operation and servicing of system and shall include circuit diagrams of systems.

E. Record Drawings:

1. Submit two "As Built" marked up drawings for all as contractor installed cable and infrastructure. To include all conduit, underground, aerial and above ground cable and pathways to/from for all buildings and each building floor.

2. Submit a full size (E) drawing of plot plan and building plans, indicating location of conduit and cable runs. Contractor shall provide drawing describing the cable pathways used in his/her installation. It is to include conduit sizes, conduit runs, conduit ID number, number of cables and types in conduit, cable type size, number of cables being carried, and the use of any inner duct. A separate redline markup (field drawn) size E drawing shall also be provided to the District Representative.

3. Contractor shall provide AutoCAD drawing in block form delineating all cable runs from beginning to end point. Drawing shall include the cable identification number, cable type, workstation faceplate ID, Patch Panel Port ID, and all empty panel ports. This drawing shall utilize a separate AutoCAD layer. Two printed E size drawings shall be presented to the District Representative and two copies of the AutoCAD V14 or newer files on Floppies.

1.06 QUALITY ASSURANCE

A. Ordinances and Regulations: The work of this Section shall conform to California Code of Regulations, Part 3, and all other applicable codes and standards.

B. Only a qualified Contractor holding C-7 or C-10 and other licenses required by legally constituted authorities having jurisdiction over the work shall do work. Contractor shall have completed at least 5 projects of equal scope to systems described herein and shall have been engaged in business of supplying and installing specified type of systems for at least 5 years. Use equipment manufacturers' certified contractors.

C. Contractor shall warranty that all work executed and materials furnished shall be free from defects of material and workmanship for a period of 1 year from acceptance date of Contract Completion, excluding specific items of work that require a warranty of a greater period as set forth in this Specification. Immediately upon receipt of written notice from the District, Contractor shall 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 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.

D. Persons skilled in trade represented by work, and in accordance with all applicable building codes, shall install system in accordance with best trade practice.

E. Contractor shall include in the Material List Submission copies of the manufacturers' certifications that the Contractor is an authorized installer of Berk-Tek and Ortronics or the submitted approved equal manufacturers' products and has been adequately trained in the installation of those products. This applies to all fiber optic components and fiber optic cable.

F. Contractor shall include in the Material List Submission a list of five projects of similar scope acceptable to the District. Contractor shall include the telephone number of the customer's client contact for each project and a letter signed by a corporate officer, partner, or owner of the contracting company describing the service capability of the company and stating the company's commitment to maintain that service capability through the warranty period.

PART 2: PRODUCTS

2.01 EQUIPMENT STANDARDS

A. Where applicable all components installed under this Contract shall be listed by UL.

B. All equipment and components including cable shall be like products of a single manufacturer.

C. Equipment Requirements:

1. All cabling and connectors shall be covered by a Berk-Tek or approved equal manufacturer warranty of not less than twenty-five years.

2.02 LOCAL AREA NETWORK CABLING

A. Category 5e and Category 6 data Cable. Horizontal enhanced category 5e cabling shall be 24 AWG, or in the case of Category 6, 23 AWG, 4-pair UTP, UL/NEC rated, with appropriately rated riser or plenum insulation and jacket materials as appropriate to the installation environment per Article 800 of the 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. Cable shall meet ANSI/TIA/EIA minimum requirements for attenuation (insertion loss), return loss, propagation delay, delay skew, NEXT loss, PSNEXT loss, FEXT loss, ELFEXT, and PSELFEXT for 4-pair Category 5e and Category 6 cabling as detailed in ANSI/TIA/EIA-568-A. Category 5e and Category 6 data cabling and patch cables shall be blue or green.

1. Manufacturer: Berk-Tek NetClear or approved equal

B. Flooded Category 5e cable for all underground applications: Category 5e cabling shall be 24 AWG, 4-pair UTP, UL/NEC rated, with appropriately rated polyethylene jacket with water blocking flooded core. Individual conductors shall be polyethylene insulated. Cable shall meet ANSI/TIA/EIA minimum requirements for attenuation (insertion loss), return loss, propagation delay, delay skew, NEXT loss, PSNEXT loss, FEXT loss, ELFEXT, and PSELFEXT for 4-pair Category 5e cabling as detailed in ANSI/TIA/EIA-568-A.

1. Manufacturer: Berk-Tek or approved equal

C. Category 5e and Category 6 Inserts. All Category 5e and Category 6 data inserts shall be wired to the T568B wiring pattern. Category 5e and Category 6 data inserts shall meet the appropriate ANSI/TIA/EIA minimum requirements for attenuation (insertion loss),return loss, propagation delay, delay skew, NEXT loss, PSNEXT loss, FEXT loss, ELFEXT, and PSELFEXT for connecting hardware as detailed in ANSI/TIA/EIA-568-A.

1. Ortronics NetClear or approved equal.

D. Category 5e and Category 6 Patch Cords. Patch cords shall be Category 5e or Category 6 rated, 24 AWG, 4 pair assemblies. Patch cords shall be factory assembled by the manufacturer of the cabling system. LAN Patch cords shall be the same color (blue or green) as the cabling system.

1. One ten-foot Category 5e or Category 6 patch cord for each work area outlet installed.

2. In the wiring closets, patch cords shall be provided in a like manner (one per user port).

3. Manufacturer: Ortronics NetClear or Approved Equal.

E. Category 5e or Category 6 Patch Panels. Patch Panels shall be provided in 24 or 48 port compliments with modular jack ports wired to T568B. Patch panels shall be augmented with cable support bars in rear to properly dress cable. All patch panels shall meet ANSI/TIA/EIA minimum requirements for attenuation (insertion loss), 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-A Quantity and size of patch panels must be selected to provide 20% expansion capacity. One EIA rack unit of horizontal wire management shall be provided adjacent to each patch panel (above and below).

1. Manufacturer: Ortronics NetClear or approved equal.

F. Faceplates. Faceplates shall be constructed of ABS molding compound and have the ability to accommodate one insert.

1. Manufacturer: Ortronics NetClear or approved equal.

G. 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 that 1.75 inches in depth unless otherwise noted in the construction documents.

1. Manufacturer: Ortronics NetClear or approved equal.

PART 3: EXECUTION AND INSTALLATION

3.01 PREMISE WIRING INSTALLATION

Site Conditions: Installer shall examine the areas and conditions under which the work of this Section will be performed. Unsatisfactory conditions shall be reported to Owner before the contractor begins work.

A. Local Area Network MCs/ICs.

1. MC/IC Category 5e and Category 6 Termination Installation.

a Category 5e or Category 6 patch panels shall be installed in 24 or 48 port compliments. Installer shall provide and install all necessary patch cords, both copper and fiber optic, for internal cabinet interconnections.

b One EIA rack unit of horizontal wire management shall be provided adjacent to each patch panel (above and below).

c Cables shall be dressed and terminated in accordance with TIA/EIA-568-A, manufacturer recommendations, and this Specification.

d Pair untwist at the termination shall not exceed one half an inch for Category 5e or Category 6 connecting hardware.

e Bend radius of the cable in the termination area shall not be less then 4 times the outside diameter of the cable.

f Cables shall be neatly bundled, not overly tight, and dressed to their respective panels or blocks. Cable wraps shall not be tight enough to disturb the internal cable pair twists.

g The cable jacket shall be maintained as close as possible to the termination point.

h Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties.

i Patch cords used at the rack or cabinet shall be either single-mode or multi-mode duplex fiber or Category 6, 24 AWG, 4-pair assemblies, as required.

j Cable shall be installed in accordance with manufacturers' recommendations and best industry practices.

k Cable raceways shall not be filled greater than the NEC maximum fill for the particular raceway type.

l Cables shall be installed in continuous lengths from origin to destination (no splices).

m When cable runs are being installed, provide additional slack at both ends to accommodate future cabling system changes. The minimum amount of allowable slack at the:

(1) Telecommunications Room or Equipment Room is 10 ft.
(2) User Outlet is 12 in.
(3) Include the slack in all length calculations to ensure that the cable does not exceed maximum allowable lengths as defined herein. Do not store slack in bundled loops. Store cable slack in an extended loop or in a figure 8 configuration to alleviate stress.

n The cable's minimum bend radius and maximum pulling tension shall not be exceeded.

o The Installer shall replace any cable damaged or subjected to installation practices outside of those specified within this document.

2. Horizontal Cabling

a Copper Horizontal distribution cable shall be TIA/EIA-568-A, Category 5e or Category 6, 4-pair unshielded twisted pair (UTP), and CMP or CMR rated cable, as required. Each Category 5e or Category 6 cable shall be terminated on an 8-position, 8-conductor

Category 5e or Category 6 jack (at the workstation locations) or patch panel (in the MC/IC/TR) wired in accordance with T568B. Associated faceplates shall accommodate four jacks. Quantities of cables to each outlet shall be in accordance with the location type and project document.

(1) Cable shall be installed in accordance with manufacturers' recommendations and best industry practices.
(2) Copper horizontal cable shall not exceed 90 meters in length.
(3) Cable raceways shall not be filled greater than the NEC maximum fill for the particular raceway type.
(4) Cables shall be installed in continuous lengths from origin to destination (no splices or cross-connects).
(5) The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
(6) Unshielded twisted pair cable shall be installed so that there are no bends less than four times the cable outside diameter.
(7) When cable runs are being installed, provide additional slack at both ends to accommodate future cabling system changes. The minimum amount of allowable slack at the:

    (a) MC, IC, TC will be 3 ft.
    (b) Work Area Outlets will be 12 inches

(8) If a J-Hook or trapeze system is used to support cable bundles in dropped ceiling or concealed ceiling spaces, all horizontal cables distributed using J-Hooks shall be supported at a maximum of four-foot intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.

    (a) Cable installed above fire-sprinkler systems shall not be attached to the system plumbing or any ancillary equipment or hardware.
    (b) Cables shall not be attached to ceiling grid or lighting support wires.

(9) Pulling tension on 4-pair UTP cables shall not exceed 25 pounds for a single cable or cable bundle.
(10) The Installer will replace, before terminations are completed, any cables damaged or subjected to installation practices outside of those specified within this document, at Installer's expense.

3. Labeling and Marking

a Provide complete cable location chart and as-built documentation in an envelope and attach to the inside rear doors of distribution frame cabinets in wiring spaces.

b Mark distribution panels, cables and cover plates with computer-generated labels. Drops shall be labeled with the same identifier on the receptacle faceplate, inside each junction box, on the cable at the jack, on the cable at the patch panel, on the termination side of the patch panel, and on the patch side of the patch panel. Cable markers shall be located within 2 inches of the end of the cable jacket and shall be directly readable. Panel labels shall be computer-generated and printed using a laser printer. A disk with the label files shall be submitted as part of the project record documents.

3.02 CERTIFICATION AND TESTING

Provide the Owner's Authorized Representative with copies of factory calibration certificates for each test set used in the testing procedures. All test equipment used shall have been factory calibrated within the previous 12 month period. Operators of the test equipment shall have factory training in the use of the equipment and its software. All cables and termination hardware shall be 100% tested for defects in installation and to verify cable performance under installed conditions. All conductors of each installed cable shall he verified useable by the Installer prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

A. Local Area Network

1. Copper

a Each cable shall be tested for continuity on all pairs and/or conductors.

b Category 5e and Category 6 data cable shall be performance verified using an automated test set for Category 5e link or Category 6 configurations.

c Test set shall be certified Level IIE for Category 5e or Level III for Category 6. To ensure verifiable equipment calibration, the Owner may require field calibration each time a new set of tests are performed. Test for the continuity parameters defined above, and provide results for the performed tests. This test set shall be

capable of testing for the continuity and length parameters defined above, and provide results for the following tests:

(1) Attenuation (insertion loss)
(2) Wire Map
(3) Attenuation to Crosstalk Ratio ACR
(4) Pair-to-pair NEXT loss
(5) PSNEXT loss
(6) Return Loss
(7) Pair-to-pair ELFEXT
(8) PSELFEXT
(9) Propagation delay
(10) Delay skew
(11) Cable length

d Cable length shall be tested using the cable manufacturers' published Nominal Velocity of Propagation (NVP) parameter. Owners Quality Assurance Agent shall verify the NVP setting. Generic settings not using the published NVP parameter will not be accepted.

e Test results shall be automatically evaluated by equipment, using the most up-to-date criteria from the ANSI/TIA/EIA-568-A standard and the result shown as pass/fail.

f Test results shall be printed directly from the test unit in native format, and both hard and soft copies in native format shall be provided to the Owner. The printed test results shall include tests performed, the expected test result, and the actual test result.

2. Completion. Installer's work for the installation shall be considered complete after the following have been accomplished:

a All system testing has been completed; Installer certifies that entire system is in working order Cable Test Forms and equipment specific test documentation (both files and paper records) have been submitted to the Owner.

b All ceiling panels previously removed have been put back in place.

c All system labels have been put in place.

d All construction debris and scrap materials have been removed from project site.

e All marked up, project record documents have been returned to the Owner.

f All unused customer material has been returned to the Owner.

g The Owner has successfully completed acceptance testing of the network wiring installation.

h The Owner's Inspector has inspected and accepted the installation.

3.03 PROJECT RECORD DOCUMENTS

A. As-Built Documentation

1. Block diagrams indicating all items and their point-to-point connections in a manner following floor plan layout.

B. Operating and Servicing Manuals, Record Drawings:

1. Deliver three (3) copies of operating, specification descriptions, and/or service manual. Each complete manual shall be bound in a three ring binder, and all data shall be typewritten or drafted.

a Each manual shall include a page with Project site and Project name, date of Substantial Completion, Contractor name, address, telephone, and fax numbers.

b Each manual shall contain a letter, signed by an officer of the company indicating the beginning and ending date of any warranties described in subsection 1.07 of this specification and shall describe the companies' commitment to service the warranty during the terms specified.

c Each manual shall include all specifications and instructions necessary for proper operation and servicing of system.

d Each Manual shall include installation and coordination drawings specifically related to this section shall be included as follows:

(1) Size A (8-1/2 inch x 11 inch) and size B (11 inch x 17 inch) shall be bound into the manual.
(2) Larger drawings shall be folded and inserted into transparent envelopes and bound into the manual.

2. Deliver two (2) copies of Record drawings on labeled CD's (Compact Disks) representative of the work performed shall be presented at completion of work in the most recent Autodesk's AutoCAD format (.dwg), for Microsoft Windows.

a The submittal shall contain all systems wiring installed including telephone, LAN, and any other low voltage system Contractor-installed wiring.

b The submittal shall consist of two electronic copies on CD-ROM and three paper record copies on no less than "E" size drawings, presented prior to the acceptance inspection.

c Owner utilizes layers as a key tool in controlling visibility of drawing elements and to provide consistent information between drawings, yet provide control over what is seen on each sheet. Premise wiring shall be shown on a separate layer, labeled as "Premise Wiring" that uses both building floor plans and conduit supporting structure layers below. The use of any version control blocks or company logos shall be on a layer separate from the premise wiring as-built drawings.

d All AutoCAD files (software copies) supplied shall be multi-layer drawings with the following layers as a minimum:

(1) Layer 1 shall contain title blocks only.
(2) Layer 2 shall contain building or site plan backgrounds only.
(3) Layer 3 shall contain terminal cabinets, devices, cabling and other system components.

C. Cable Numbering Records

1. Owner requires both labeling and record documentation at the conclusion of each cable installation project. Labels and cable records allow the Owner to locate, identify and diagnose cases of trouble more efficiently. They are required for each cable installation project regardless of size and scope.

a Installation Contractor shall provide a cable management spread sheet that shall include the following:

(1) Cable Schedule
(2) Cable Test Forms
(3) Cable Labels
(4) Network planning chart.

b Present the data in an Excel spread sheet that will operate on Windows 98/2000/XP platforms. Information shall be presented in paper and electronic forms in a format that will be provided by the Owner.

c A paper copy of the cable schedule in a transparent plastic sleeve shall be affixed to the front door of each Intermediate and Local distribution frame (IDF and LDF). In the MDF cabinet, the cable schedule shall be affixed to the rear door of the cabinet.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.05 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.06 OWNER ORIENTATION

A. Completed shop drawings, as specified in Section 3.04 above shall serve as the Owner's orientation.

END OF SECTION