PROJECT MANUAL

DSA A# 03-123063

Rosemead High School Gymnasium HVAC and Roofing Replacement

El Monte Union High School District

Rosemead, CA

RACHLIN PARTNERS | A Huckabee COMPANY

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PROJECT MANUAL

FOR

Rosemead High School Gymnasium HVAC and Roofing Replacement

AT

Rosemead High School
9063 Mission Dr
Rosemead, CA 91770

Prepared by

RACHLIN PARTNERS INCORPORATED
8640 National Boulevard
Culver City, California 90232

For

El Monte Union High School District
3537 Johnson Avenue
El Monte, CA 91731

March 6, 2023

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PROJECT DIRECTORY

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SECTION 00004

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STRUCTURAL ENGINEER
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MECHANICAL AND PLUMBING ENGINEER
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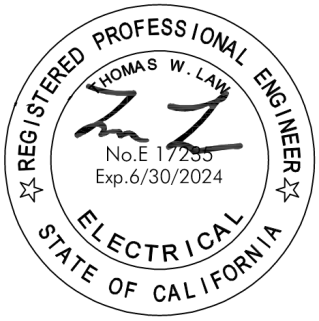

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IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-123063 INC:
REVIEWED FOR
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DATE: 09/13/2023

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SECTION 00010

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SECTION 01 1100

SUMMARY OF WORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The furnishing of all labor, materials, equipment, services, and incidentals necessary for Work of the **Gymnasium HVAC and Roofing Replacement** at **Rosemead High School** located at **9063 Mission Dr, Rosemead, CA 91770** as set forth in the Construction Documents which include, but are not limited to, the Drawings, Addenda and Specifications.

1.02 RELATED REQUIREMENTS:

1. Section 01 1216: Phasing of the Work.

3. Section 01 3113: Project Coordination.

4. Section 01 3229: Project Forms.

5. Section 01 3216 Construction Schedule Small Projects

6. Section 01 4525: Testing, Adjusting, and Balancing for HVAC.

7. Section 01 5000: Construction Facilities and Temporary Controls.

8. Section 01 7123: Field Engineering.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 USE OF PREMISES

A. CONTRACTOR shall coordinate Work of all trades, Subcontractors, utility service providers, with OWNER and/or Separate Work Contract. CONTRACTOR shall sequence, coordinate, and perform the Work to impose minimum hardship on the operation and use of the existing facilities and/or Project site. CONTRACTOR shall install all necessary protection for existing improvements, Project site, property, and new Work against dust, dirt, weather, damage, vandalism, and maintain and relocate all protection to accommodate progression of the Work.

B. CONTRACTOR shall confine entrance and exiting to the Project site and/or facilities to routes designated by the OAR.

C. Within existing facilities, OWNER will remove portable equipment, furniture, and supplies from Work areas prior to the start of Work. CONTRACTOR shall cover and protect remaining items in areas of the Work.

D. CONTRACTOR is advised school may be in session during performance of the Work. CONTRACTOR shall utilize all available means to prevent generation of unnecessary noise and maintain noise levels to a minimum. When required by the OAR, CONTRACTOR shall immediately discontinue noise-generating activities and/or provide alternative methods to minimize noise generation. CONTRACTOR shall install and maintain air compressors, tractors, cranes, hoists, vehicles, and other internal combustion engine equipment with mufflers, including unloading cycle of compressors. CONTRACTOR shall discontinue operation of equipment producing objectionable noise as required by the OAR.

E. CONTRACTOR shall furnish, install, and maintain adequate supports, shoring, and bracing to preserve structural integrity and prevent collapse of existing improvements and/or Work modified and/or altered as part of the Work.

F. CONTRACTOR shall secure building entrances, exits, and Work areas with locking devices as required by the OAR.

G. CONTRACTOR assumes custody and control of OWNER property, both fixed and portable, remaining in existing facilities vacated during the Work.

H CONTRACTOR shall cover and protect surfaces of rooms and spaces in existing facilities turned over for the Work, including OWNER property remaining within as required to prevent soiling or damage from dust, dirt, water, and/or fumes. CONTRACTOR shall protect areas adjacent to the Work in a similar manner. Prior to OWNER occupancy, CONTRACTOR shall clean all surfaces including OWNER property.

I. CONTRACTOR shall not use or allow anyone other than OWNER employees to use facility telephones and/or other equipment, except in an emergency. CONTRACTOR shall reimburse OWNER for telephone toll charges originating from the facility except those arising from emergencies or use by OWNER employees.

J. CONTRACTOR shall protect all surfaces, coverings, materials, and finished Work from damage. Mobile equipment shall be provided with pneumatic tires.

K. CONTRACTOR is advised OWNER will award Separate Work Contracts at this Project site.

L. CONTRACTOR shall not permit the use of portable and/or fixed radio’s or other types of sound producing devices including walkmans and similar devices.

3.02 PROPERTY INVENTORY

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

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

A. Certain materials identified in the Contract Documents as OWNER Furnished CONTRACTOR Installed, OFCI, will be delivered to the Project site by the OWNER.

B. If designated in the Contract Documents to be OWNER furnished CONTRACTOR installed, (OFCI), CONTRACTOR shall unload, store, uncrate, assemble, install, and connect OWNER supplied materials.

C. One-Hundred and Twenty days before the date the CONTRACTOR needs to have the OFCI materials on site, CONTRACTOR shall notify OWNER of the scheduled date for needed OFCI materials. Upon delivery to Project site, CONTRACTOR shall store OFCI materials inside rooms and/or protected spaces and will be responsible for security of OFCI materials until Substantial Completion. OAR will sign receipt or bill of lading as applicable.

D. CONTRACTOR shall, within ten days after delivery, uncrate and/or unpack OFCI materials in presence of OWNER who shall inspect delivered items. OWNER shall prepare an inspection report listing damaged or missing parts and accessories. OWNER shall transmit one copy of the report to CONTRACTOR. OWNER will procure and/or replace missing and or damaged OFCI materials, as indicated in inspection report.

E. CONTRACTOR shall install OFCI materials in the locations and orientation as indicated in the Contract Documents. CONTRACTOR shall verify exact locations with OAR before final installation of OFCI materials.

F. If required, OAR will furnish setting and or placement drawings for OFCI materials.

G. CONTRACTOR shall install OFCI materials by proper means and methods to ensure an installation as recommended by the manufacturer. CONTRACTOR shall furnish and install all necessary fasteners and required blocking to properly install OFCI materials.

H. CONTRACTOR shall install OFCI materials with manufacturer recommended fasteners for the type of construction to which the OFCI materials are being fastened and/or anchored.

I. CONTRACTOR shall provide final connections of any electrical, signal, gas, water, waste, venting and/or similar items to OFCI materials. CONTRACTOR shall, prior to final connection, verify the operating characteristics of OFCI materials are consistent with the designated supply.

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

A. Certain materials are identified in the Contract Documents as OWNER Furnished, OWNER Installed (OFOI)

B. On dates and during times designated by OWNER, CONTRACTOR shall provide clear off-loading, receiving, protected storage, and OWNER'S dumpster space areas for the use of OWNER or OWNER'S third party OFOI installation contractors. At such times, CONTRACTOR shall also make clear routes and access available to all rooms and spaces to receive OFOI materials.

C. On dates and during times designated by OWNER, CONTRACTOR shall provide access to the elevators for use of OWNER or OWNER'S third party OFOI installation contractors.

D. CONTRACTOR shall cooperate fully with OWNER or OWNER'S third part OFOI installation contractors.

E. CONTRACTOR may be requested by OWNER to provide supplemental labor and equipment to support OFOI activities. Such requests must be submitted in accordance with the change order clauses of Contract.

F. Immediately prior to mobilization of OWNER or OWNER'S third party OFOI installation contractors, OWNER shall document the condition of the Work in areas to be utilized for OFOI activities.

G. CONTRACTOR shall not be responsible for damage caused by OWNER or OWNER'S forces. OWNER shall document the condition of the Work and report to CONTRACTOR any damage in areas utilized for OFOI activities.

END OF SECTION

SECTION 01 2513

PRODUCT PROCEDURES FOR SUBSTITUTION AND “OR EQUAL”

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes administrative and procedural requirements for handling requests for substitutions and “or equal” submitted pursuant to Article 6.14 of the General Conditions.

1.02 RELATED REQUIREMENTS

A. Section 01 3229: Project Forms.

B. Section 01 3300: Submittal Procedures.

C. Section 01 6000: Product Requirements.

D. Section 01 7700: Contract Closeout.

1.03 APPLICATION

A. OAR will review CONTRACTOR proposed changes in products or materials required by the Contract Documents.

1. Substitutions: OAR will consider requests for substitution if a product is no longer manufactured or the OAR and ARCHITECT, after a diligent search have verified that product or material is not available to CONTRACTOR. The following are not considered to be valid requests for substitutions:

a. Revisions to the Contract Documents requested by OAR or ARCHITECT.

b. Specified options of products included in the Contract Documents.

c. Substitutions requested on a “or equal” basis.

2. “Or Equal”: OAR will consider requests for “or equal” if submitted within the time indicated in Article 6.14 of the General Conditions.

1.04 SUBMITTALS

A. Transmit submittals as described in related Sections for each request for substitution or “or equal”.

1. Identify the product to be replaced in each request. Include related Specification Section and Drawing number.

2. Provide complete documentation denoting compliance with the requirements for substitutions, and the following information, as appropriate.

   a. A detailed comparison of significant qualities of the proposed substitution with those specified in the Contract Documents. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.

   b. Product Data, including Drawings, descriptions of products, fabrication, and installation procedures.

   c. Samples, where applicable or requested.

   d. CONTRACTOR certification the proposed substitution or “or equal” conforms to requirements of the Contract Documents in every respect and is appropriate for the applications indicated.

   e. CONTRACTOR waiver of rights to an increase in the Contract Amount, Milestones and/or Contract Time.

3. If required, OAR and ARCHITECT will request additional information or documentation for evaluation.

4. ARCHITECT will review requests for substitutions and “or equals” and provide a recommendation to OAR.

5. If ARCHITECT accepts proposed substitutions or “or equals” OAR will forward submittals to the OWNER’s Maintenance and Operations Technical Unit for review. OAR will notify CONTRACTOR of acceptance or rejection of the substitution.

6. Where a proposed substitution or “or equal” involves and/or affects more than one Subcontractor, CONTRACTOR shall ensure each Subcontractor cooperates with the other Subcontractor involved to coordinate the Work, provide uniformity and consistency, and assure compatibility of all products.

7. CONTRACTOR submittal and ARCHITECT review of Shop Drawings, Product Data, material lists or Samples do not constitute an acceptable or valid request for substitutions or “or equals”.

2. PART 2 - PRODUCTS (Not used)

3. PART 3 – EXECUTION (Not used)

END OF SECTION

SECTION 01 2613

REQUEST FOR CLARIFICATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

A. Section 01 1100: Summary of Work.

B. Section 01 3113: Project Coordination.

C. Section 01 3216 Construction Schedule Small Projects.

D. Section 01 3229: Project Forms.

E. Section 01 7700: Contract Closeout.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 PROCEDURE

A. CONTRACTOR shall prepare a Request for Clarification on the form provided in Section 01 3229. CONTRACTOR shall transmit the Request for Clarification to ARCHITECT with a concurrent copy to the OAR.

B. ARCHITECT response is a clarification of the intent of the Contract Documents and does not authorize changes in the Contract Amount, Milestones and/or Contract Time.

C. A Request for Clarification may be returned with a stamp or notation "Not Reviewed," if:

1. The requested clarification is ambiguous or unclear.

2. The requested clarification is equally available to the requesting party by researching and/or examining the Contract Documents.

3. CONTRACTOR has not reviewed the Request for Clarification prior to submittal.

D. Allow a minimum of nine days for review and response time, after receipt by ARCHITECT and OAR. CONTRACTOR shall verify and is responsible in verifying ARCHITECT and OAR receipt of a Request for Clarification.

E. Changes or alterations to the approved drawings or specifications shall be made by means of addenda or change orders as per section 4-338 of the California Building Standards Commission's, California Administrative Code.

END OF SECTION

SECTION 01 2973

SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

A. Section 01 2976: Progress Payment Procedures.

B. Section 01 3113: Project Coordination.

C. Section 01 3216: Construction Schedule.

D. Section 01 3229: Project Forms.

E. Section 01 3300: Submittal Procedures.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 PREPARATION

A. Upon receipt of the Notice of Intent to Award, CONTRACTOR shall commence preparation of a Schedule of Values in accordance with the form included in Section 01 3229.

B. CONTRACTOR shall coordinate the preparation of a Schedule of Values with preparation of the Construction Schedule as set forth in Section 01 3213. The corresponding values from the specification division totals on cost loaded schedule shall match with the approved Schedule of Values.

C. Include the following Project identification on a certified Schedule of Values:

1. Project name and location.

2. Project Number.

3. Contract #.

4. CONTRACTOR name.

5. Date of Submittal.

D. The Schedule of Values shall be in tabular form with separate columns and shall include the following items:

1. Related Specification Section and Division.

2. Description of Work.

3. Name of Subcontractor, manufacturer or supplier.

4. Dollar value, quantity and unit of measure of each line item.

5. Percentage of Contract amount to nearest one-hundredth percent, adjusted to total 100 percent.

E. Round amounts to the nearest whole dollar; the total shall equal the Contract Amount.

F. Provide a breakdown of the Contract Amount in enough detail acceptable to OAR to facilitate continued evaluation of Application for Payment and progress reports. Coordinate with the Project Manual table of content and Schedule of Values form under Section 01 3229. Provide line items for subcontract amounts, where appropriate.

G. Provide separate line items for items in the Schedule of Values for total installed value of that part of the Work.

H. Provide separate line item for labor and material when required by the OAR.

I. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item except the amounts shown as separate line items as indicated under Schedule of Values form under Section 01 3229.

J. Temporary facilities and other cost items that are not direct cost of actual work-in-place shall be shown as separate line items as indicated under Schedule of Values form under Section 01 3229.

K. An approved certified Schedule of Values shall serve as the basis for the monthly certified Application for Payment.

L. If at any time, OWNER determines, in its reasonable discretion, that the schedule of Values does not approximate the actual cost being incurred by CONTRACTOR to perform the Work, CONTRACTOR shall prepare, for OAR approval, a revised Schedule of Values, which then shall be used as the basis for future progress payments. Without changing the Contract Amount, OWNER reserves the right to require CONTRACTOR:

1. To increase or decrease amounts within the line items in the Schedule of Values; and,

2. To conform the price breakdown to OWNER accounting practice.

3.02 SUBMITTAL

A. CONTRACTOR shall submit five certified copies of a Schedule of Values for review and approval by the OAR at least 14 days before the first Application for Payment.

B. OAR will review and if necessary, return the submitted Schedule of Values with summary comments noting items not in compliance with the requirements of the Contract Documents. CONTRACTOR shall revise the submitted Schedule of Values and return five copies within three days of receipt of summary comments.

C. Signature by OAR shall constitute acceptance of the submitted Schedule of Values.

D. An approved copy of the Schedule of Values by OAR will be transmitted to CONTRACTOR, and Inspector.

END OF SECTION

SECTION 01 2976

PROGRESS PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. This Section specifies administrative and procedural requirements for a certified Application for Payment.

1. Coordinate the certified Schedule of Values and certified Application for Payment with, but not limited to, the Construction Schedule, submittal log, and list of Subcontractors.

1.02 RELATED REQUIREMENTS:

A. Section 01 2973: Schedule of Values.

B. Section 01 3216: Construction Schedule.

C. Section 01 3229: Project Forms.

D. Section 01 7700: Contract Closeout.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 APPLICATION FOR PAYMENT

A. Each certified Application for Payment shall be consistent with previous applications and payments as reviewed by OAR, paid for by OWNER, and:

1. The initial Application for Payment and Final Application for Payment at time of Substantial Completion involve additional requirements.

B. Payment Application Times: The period of Work covered by each Application for Payment is payment date for each progress payment as specified in the General Conditions. The period covered by each Application for Payment is previous month.

C. Payment Application Forms: Use OWNER provided forms for the Application for Payment.

D. Application Preparation: Complete every entry on the form. Include execution by a person authorized to sign legal documents on behalf of CONTRACTOR. OAR will return incomplete applications without action.

E. Transmittal: Submit a minimum of four signed and original copies of each certified Application for Payment to OAR. All copies shall be complete, including releases and similar attachments.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to OAR.

F. Initial Application for Payment within 60 days of issuance of Notice to Proceed: Administrative actions and submittals, that must precede or coincide with submittal for first certified Application for Payment include, but are not limited to, the following:

1. Certified Schedule of Values.

2. Performance and payment bonds.

3. List of principal suppliers and fabricators.

4. Worker Compensation certificates, if applicable.

5. Auto Insurance, if applicable.

6. Hazardous Material Insurance Certificates, if applicable.

7. Construction Schedule.

8. Submittal Schedule.

9. Emergency Contact List.

10. Copies of authorizations and licenses from governing authorities for performance of Work.

11. Certified Payroll (Submitted directly to Labor Compliance in electronic format as specified by OWNER including hard copy).

12. Storm Water Pollution Prevention Plan (SWPPP).

13. Certification of Compliance with CEQA Mitigations.

G. Applications for Payment: Administrative actions and submittals that must precede or coincide with submittal of Progress Applications for Payment include, but are not limited to, the following:

1. Certified Payroll (submitted directly to Labor Compliance in electronic format as specified by OWNER including hard copy).

2. Updated and current Project Record Drawings (as-built).

3. Monthly Construction Schedule (updated, submitted and approved).

4. Approved Schedule of Values.

5. List of Subcontractors (Payments Summary).

6. Storm Water Pollution Prevention (SWPP) – Site Monitoring Report.

7. Certification of Compliance with CEQA Mitigations.

H. Final Application for Payment at Substantial Completion: Following OAR issuance of certificate of Substantial Completion, submit an Application for Payment:

1. Administrative actions, submittals and/or Work that shall precede or coincide with this application include:

a. Occupancy permits and similar approvals by authorities having legal jurisdiction over Work..

b. Removal of temporary facilities and services.

c. Testing, adjusting and balance records.

d. Removal of surplus materials, rubbish, and similar elements.

e. Meter readings.

f. Start-up performance reports.

g. OWNER training and orientations.

h. Operating and maintenance instruction manuals.

i. Preliminary Warranties, guarantees and maintenance agreements.

j. Delivery of extra materials, products and or stock.

k. Change over information related to OWNER occupancy, use, operation, and maintenance.

l. Final cleaning.

m. Ensure that Work is completed.

n. Advise on shifting insurance coverage.

o. List of defective Work, recognized as exceptions to certificate of Substantial Completion.

p. Change of door locks, including keys, to OWNER system.

q. Certified Payroll (submitted directly to Labor Compliance in electronic format as specified by the OWNER including hard copy).

r. Certification that all benefit contributions due and owing to appropriate union trusts has been paid by CONTRACTOR and Subcontractors, as

specified by the Project Stabilization Agreement (PSA) and Article 6.49 of the General Conditions.

s. Storm Water Pollution Prevention – Site Monitoring Reports, SWPP revisions, compliance certifications, and Notice of Termination (NOT) (see Section 01 7416).

t. Certification of Compliance with CEQA Mitigations.

u. Waivers and releases for CONTRACTOR.

END OF SECTION

SECTION 01 3113

PROJECT COORDINATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies administrative and procedural requirements necessary for coordinating Work operations including, but not limited to, the following:

1. General coordination procedures.

2. Coordination drawings.

1.02. RELATED REQUIREMENTS

A. Section 01 3216: Construction Schedule.

B. Section 01 3300: Submittal Procedures.

C. Section 01 4523: Test and Inspection.

D. Section 01 4525: Testing, Adjusting, and Balancing for HVAC.

E. Section 01 7700: Contract Closeout.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 COORDINATION

A. CONTRACTOR shall coordinate operations included in various sections of Contract Documents to assure efficient and orderly installation of each part of Work. Coordinate Work operations included under related sections of Contract Documents that depend on each other for proper installation, connection, and operation of Work, including but not limited to:

1. Schedule construction operations in sequence required where installation of one part of Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.

3. Provide provisions to accommodate items scheduled for later installation.

4. Prepare and administer provisions for coordination drawings.

B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required in notices, reports, attendance at meetings, and:

1. Prepare similar memoranda for OAR and Separate Work Contract where coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of Work. Such administrative activities include, but are not limited to, following:

1. Preparation of schedules.

2. Installation, relocation, and removal of temporary facilities.

3. Delivery and processing of submittals.

4. Progress meetings.

5. Project closeout activities.

D. Conservation: Coordinate Work operations to assure operations are carried out with consideration given to conservation of energy, water, materials, and:

1. Salvage materials and equipment involved in performance of, but not actually incorporated into Work.

3.02 SUBMITTALS

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

1. Limitations in available space for installation or service. CONTRACTOR shall overlay plans of each trade and verify space requirements and conflicts between trades. Minor changes and adjustments that do not affect design intent shall be made by CONTRACTOR and shall be highlighted for ARCHITECT'S review.

2. Incompatibility between items provided under different trades (such as difference in voltage between equipment specified under Divisions 22 and 23 and electrical power provided under Division 26.)

3. Inconsistencies between drawings, specifications and codes (between trades and within each trade).

4. Additional items required for existing facilities construction projects shall be designed and prepared from available as-built drawings that are verified through non-invasive and non-destructive, visual observation only. CONTRACTOR shall field verify actual existing conditions during and upon completion of demolition

work and incorporate findings into preparation of co-ordination drawings. Minor changes and adjustments that do not affect design intent shall be made by Sub-Contractor and shall be highlighted for OAR and ARCHITECT'S reviews.

B. Prepare coordination drawings in CAD with each trade on a separate layer, in specified color and scale. CONTRACTOR and each Subcontractor shall provide and forward reproducible copies and CAD drawing files in the order described here:

1. Structural shop drawings shall indicate location and sizes of columns, beams and other structural members, as well as wall, roof and slab penetrations, and will be provided to mechanical, electrical, low voltage and plumbing Sub-contractors for co-ordination. Structural items shall be indicated using black lines.

2. HVAC Subcontractor will indicate all ductwork, piping and equipment complete with installation and dimensioned service clearances, duct and pipe sizes, fitting types and sizes, top or bottom of duct and pipe elevations, distances of ducts, pipes and equipment from building reference points and hanger and support locations. Minor changes and adjustments that do not affect design intent shall be made by Subcontractor and shall be highlighted for OAR and ARCHITECT'S reviews. Forward drawings to plumbing Subcontractor for further co-ordination. HVAC items shall be indicated using orange lines.

3. Plumbing Subcontractor will indicate all plumbing lines, and equipment complete with installation and dimensioned service clearances, pipe sizes, fitting types and sizes, top or bottom of pipe elevations, distances of pipes and equipment from building reference points and hanger/support locations Co-ordinate with HVAC Subcontractor. Minor changes and adjustments that do not affect design intent shall be made by Sub-contractor and shall be highlighted for OAR and ARCHITECT'S reviews Upon completion drawings shall be forwarded to Fire Sprinkler Subcontractor for further co-ordination. All Plumbing items shall be indicated using blue lines.

4. Fire sprinkler Subcontractor will indicate fire sprinkler piping and equipment complete with installation and dimensioned service clearances, pipe sizes, fitting types and sizes, top or bottom of pipe elevations, distances of pipes and equipment from building reference points and hanger or support locations. Co-ordinate with Plumbing and HVAC Subcontractors. Minor changes and adjustments that do not affect design intent shall be made by sub-contractors and shall be highlighted for OAR and ARCHITECT'S reviews. Upon completion drawings shall be forwarded to Electrical CONTRACTOR for further co-ordination. Fire sprinkler equipment shall be indicated using red lines.

5. Electrical and Low Voltage Subcontractors will indicate service and feeder conduit runs and other electrical equipment complete, including low voltage with installation and dimensioned service clearances, sizes, top or bottom of conduit and rack elevations, distances of conduits and equipment from building reference points and hanger and support locations. Co-ordinate with Fire Sprinkler, Plumbing and HVAC Subcontractors. Minor changes and adjustments that do not affect design intent shall be made by sub-contractors and shall be highlighted for OAR and ARCHITECT'S reviews. Upon completion drawings shall be forwarded to CONTRACTOR for further co-ordination. Electrical work shall be indicated in dark green lines. Low voltage work shall be indicated in light green lines.

6. CONTRACTOR will be responsible for the overall coordination review. As each coordination drawing is completed, CONTRACTOR will meet with OAR to review and resolve all conflicts on coordination drawings.

7. Coordination meetings will be held in Project field office of CONTRACTOR. CONTRACTOR is required to distribute Shop Drawings, cut sheets and submittals to Subcontractors where appropriate. Reviewed coordination drawings will be maintained in Project field office of CONTRACTOR. Meeting minutes shall be developed by CONTRACTOR and submitted to OAR within 5 days.

END OF SECTION

SECTION 01 3119

PROJECT MEETINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies administrative and procedural requirements for Project meetings, including but not limited to, the following:

1. Job start meeting.

2. Pre-installation conferences.

3. Progress meetings.

4. Meetings as required by OAR.

1.02 RELATED REQUIREMENTS

A. Section 01 3113: Project Coordination.

B. Section 01 3216: Construction Schedule.

C. Section 01 3229: Project Forms.

D. Section 01 3300: Submittal Procedures.

PART 2 – PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 JOB START MEETING

A. In accordance with General Conditions Article 2.6, OAR will schedule a job start meeting before starting the Work, at a time and date determined by OAR. Meeting shall be held at the Project site or another location as determined by OAR. Meeting will be held in order to review responsibilities, procedures, and other administrative requirements contained within the Contract Documents.

B. Authorized representatives of OWNER, INSPECTOR, ARCHITECT, CONTRACTOR and other parties shall attend the meeting. All participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work.

C. Agenda items shall include significant items which could affect progress of the Work, including, but not limited to the following:

1. Preliminary Construction Schedule.
2. Critical work sequencing.
3. Designation of responsible personnel.
4. Identification of OAR.
5. Procedures for processing field decisions.
6. Request for Proposal.
7. Request for Clarification.
8. Construction Directive and Change Order.
9. Procedures for processing Applications for Payment.
10. Prevailing wages.
11. Submittal and review of Shop Drawings, Product Data, material lists, and Samples.
12. Preparation of project record documents.
13. Use of the Project site and/or premises.
14. Parking availability.
15. Office, work, and storage areas.
16. Equipment deliveries and priorities.
17. Safety procedures.
18. First Aid.
19. Security.
20. Housekeeping.
21. Working hours.
22. Contract Compliance Officer.
23. Insurance Services including OCIP.
24. Environmental Health and Safety.
25. Substantial Completion, Administrative Closeout and Contract Completion requirements and procedures.

26. Procedures for Mandatory Dispute and Claim Resolution.

27. Storm Water Pollution Prevention Plan (SWPPP).

28. CEQA Compliance.

D. OAR shall prepare and issue meeting minutes to attendees and interested parties no later than five calendar days after the meeting date.

3.02 PRE-INSTALLATION CONFERENCES

A. CONTRACTOR shall coordinate and conduct pre-installation conferences at the Project site as required by related Sections of the Contract Documents.

B. CONTRACTOR, manufacturers, and fabricators involved in or affected by the installation and its coordination or integration with other pre-ceding and/or subsequent installations of Work shall attend the meeting. CONTRACTOR shall advise OAR, INSPECTOR, and ARCHITECT of scheduled meeting dates in order to secure their attendance.

1. CONTRACTOR shall review the progress of construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for the following:

a. Contract Documents.

b. Options.

c. Related Construction Directives and Change Orders.

d. Purchases.

e. Deliveries.

f. Shop Drawings, Product Data, and quality-control samples.

g. Review of mockups.

h. Possible conflicts.

i. Compatibility problems.

j. Time schedules.

k. Weather limitations.

l. Manufacturer’s recommendations.

m. Warranty requirements.

n. Compatibility of materials.

o. Acceptability of substrates.

p. Temporary facilities.

q. Space and access limitations.

r. Governing regulations.

s. Safety.

t. Inspecting and testing requirements.

u. Required performance results.

v. Recording requirements.

w. Protection.

2. CONTRACTOR shall record significant discussions and directives received from each conference. CONTRACTOR shall, within three (3) calendar days after the meeting date, distribute the minutes of the meeting to all concerned parties, including but not limited to, OAR, INSPECTOR, and ARCHITECT.

3.03 PROGRESS MEETINGS

A. Progress meetings will be held at the Project site at regular intervals, typically weekly, as determined by the OAR.

B. In addition to representatives of CONTRACTOR, OWNER, and ARCHITECT, each Subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of the Work shall, if requested by OAR, be represented at these meetings. All participants at the conference shall be familiar with the Project and authorized to conclude all matters relating to the Work.

C. Failure of CONTRACTOR to be so represented at any progress meeting which is held at a mutually agreed time or for which a written notice is given, shall not relieve CONTRACTOR from abiding by any and all OAR determinations or directives issued at such meeting.

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

1. Interface requirements.

2. Construction Schedule.

3. Sequence and coordination.

4. Status of submittals / RFCs.

5. Deliveries.

6. Off-site fabrication.

7. Access.

8. Site utilization.

9. Temporary Construction Facilities and Controls.

10. Hours of work.

11. Hazards and risks.

12. Housekeeping.

13. Quality of materials, fabrication, and execution.

14. Unforeseen conditions.

15. Testing and Inspection.

16. Defective Work.

17. Construction Directive.

18. Request for Proposal.

19. Change Order Proposals and Change Orders.

20. Documentation of information for payment requests.

21. Application for Payment.

22. Other items as required or as brought forth..

23. Initial Notice of Start of Issue, Event, Condition, Circumstance, or Cause of Perceived Delay, Disruption, Interference, Hindrance, Acceleration. (Article 12.2.1 of the General Conditions).

24. Final Notice of End of Issue, Event, Condition, Circumstance, or Cause of Perceived Delay, Disruption, Interference, Hindrance, Acceleration (Article 12.2.2 of the General Conditions).

25. Storm Water Pollution Prevention.

26. CEQA Compliance.

E. No later than three (3) calendar days after each progress meeting, OAR will prepare and distribute minutes of the meeting to each present and absent party. Include a brief summary, in narrative form, of progress, decisions, directives, actions taken, and all other issues since the previous meeting and report.

1. Schedule Updating: CONTRACTOR shall revise the Construction Schedule after each progress meeting where revisions to the schedule have been made or

recognized, and issue the revised schedule at the next scheduled progress meeting.

3.04 ADDITIONAL MEETINGS

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

3.05 OWNER'S RIGHT TO RECORD

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

END OF SECTION

SECTION 01 3129

PARTNERING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. The furnishing of labor, materials, equipment, services, and incidentals necessary for a Partnering Agreement process.

B. This specification requires the use of a formal Partnering process between OWNER and CONTRACTOR. Partnering is a collaborative effort and a long-term commitment between two or more organizations for the purpose of achieving specific project objective by maximizing the efficiency and effectiveness of each organizations participation in meeting specific project requirements. This effectiveness requires changing traditional “individualized” relationships to “shared culture” relationships without regard to organizational boundaries. The partnering relationship is based upon trust, dedication to common goals, understanding of each other’s individual expectations and values, and a full commitment to success. Benefits include improved communications, efficiency and cost effectiveness, increased opportunity for innovation, and the continuous improvement of product quality and services.

C. The OWNER’S Partnering process applies these concepts to the delivery of new facilities. By using partnering in this contract, the OWNER seeks to maximize the opportunity to achieve project success measured by how well the project meets the operational requirements for the school, financial constraints for the parties, the school schedule constraints, safety, quality, functional requirements of the project, and the need to employ appropriate levels of risk management throughout the project.

1.02 SUBMITTALS

A. CONTRACTOR shall, upon Notice of Intent to Award, begin arranging for the Partnering workshop. CONTRACTOR shall provide a list of CONTRACTOR employees, subcontractors, and other personnel the CONTRACTOR anticipates will attend the meeting. The attendee list shall include the job title of each person, an email address, telephone and fax number

B. CONTRACTOR shall propose at lease three facilitators and submit their names to the OWNER for review and mutual agreement with OWNER as to a facilitator for the project Partnering process. CONTRACTOR shall provide resumes of the proposed facilitators as well as information about each facilitator’s business including, but not limited to years in business, references and proposed agenda.

C. CONTRACTOR shall recommend a location and a date for the initial workshop for mutual agreement between CONTRACTOR and OWNER.

D. At the completion of the initial Partnering workshop, and any follow up meetings, within 15 days thereafter the Facilitator shall provide to CONTRACTOR and OWNER the following:

1. Copies of meeting minutes for attendees in accordance with the agenda detailing the issues addressed, actions required and comments made by all parties. The summary shall be provided in electronic format in MS Word for email distribution.

2. Partnering Charter in sufficient quantities for attendees and file copies for primary parties involved.

3. Proposal for follow up meetings if required.

PART 2 - PRODUCTS - (Not Used)

PART 3 – EXECUTION

3.01 PARTNERING PROCEDURES

A. Initial Partnering Meeting: The initial Partnering Workshop shall be an all day meeting or as mutually agreed between OWNER and CONTRACTOR. The initial meeting may be prior to or combined with the pre-construction conference, but shall occur no later than the Notice to Proceed. The number of follow up meetings will be as required in Article 3.01.C below. OWNER and CONTRACTOR shall:

1. Mutually agree upon the scope, agenda, attendees, and a location for the meeting.

2. Use a facilitator to organize and conduct the meetings:

a. The facilitator is to act as a neutral party. There must be no conflict of interest on the part of the facilitator in favor of OWNER, CONTRACTOR or ARCHITECT.

b. OWNER and CONTRACTOR will provide the Facilitator with a list of attendees. OWNER will be approximately **# (OAR insert the number of people as appropriate)** people in attendance.

c. The meeting arrangements (meeting space, audio visual equipment etcetera) will be the responsibility of the Facilitator.

d. CONTRACTOR and OWNER will be responsible for expenses incurred by their respective employees, including to not limited to meals, travel and lodging.

e. The Facilitator should contact OWNER and CONTRACTOR at least three weeks prior to the workshop, and have a conference call with the parties at least 10 calendar days prior to the workshop to discuss ideas and to finalize the agenda. The agenda will be based on the needs of the project delivery team, and may be as specific as deemed necessary. The Facilitator is responsible for developing the full agenda in conjunction with both parties.

B. Participation in Partnering: It is the responsibility of OWNER and CONTRACTOR to compile a list of and invite the key project personnel to participate in the partnering workshops, as well as key representatives of interested parties in attendance. Examples include, but are not limited to ARCHITECT, DSA, Project Inspector, subcontractors, material suppliers, city and county officials, local jurisdictions, and utility companies. CONTRACTOR and OWNER shall encourage staff to attend and actively participate in the partnering process. CONTRACTOR and OWNER agree that the personnel identified and attending the workshop will be assigned to the project.

C. Payment: The cost of the initial partnering workshop will be paid by CONTRACTOR. CONTRACTOR will be responsible for arranging the partnering workshop (meeting room, audio visual equipment, supplies, cost of facilitator, etcetera). Expenses for miscellaneous incidentals shall be paid for out of this cost.

1. CONTRACTOR shall allow for # (**OAR insert number of follow up meetings anticipated)** follow up meetings. Follow up meetings shall be **(OAR to select length of follow up sessions by size of contract. If contract will be less than $25 million, use half day session. If Contract value is greater than $25 million, use full day sessions.)** half or full day meetings as mutually agreed by OWNER and CONTRACTOR. These meetings shall be conducted in accordance with this specification.

OR

1. Follow up partnering meeting would be scheduled on a quarterly basis. These meetings will generally be "executive" level involving CONTRACTOR, ARCHITECT, Project Inspector and OWNER only. The cost of these meetings shall be borne by CONTRACTOR. For planning purposes, these meetings will generally be one one-half days in duration and may be held at the jobsite of other facility available to CONTRACTOR.

END OF SECTION

SECTION 01 3216

CONSTRUCTION SCHEDULE
(SMALL PROJECT/SHORT DURATION)

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Required procedures for the development of the Baseline Construction Schedule, Monthly Schedule Update, Four-Week Rolling Schedule, Recovery Schedules, Fragnets and Time Extension requests.

1.02 RELATED REQUIREMENTS

A. Section 01 1100: Summary of Work.

B. Section 01 1216: Phasing of the Work.

C. Section 01 2973: Schedule of Values.

D. Section 01 3300: Submittal Procedures.

E. Section: 01 3119: Project Meetings.

F. Section 01 4523: Testing and Inspection.

G. Section 01 7416: Storm Water Pollution Prevention Plan.

H. Section 01 7700: Contract Closeout.

PART 2 – PRODUCTS

2.01 SCHEDULING SOFTWARE

A. CONTRACTOR shall utilize the latest version of Primavera Scheduling Software (P6) to employ the Critical Path Method (CPM) in the development and maintenance of the construction schedule. If the version of Primavera Scheduling Software (P6) used is greater than Version 15.1, the CONTRACTOR shall save & export schedules in Version 15.1 before submitting to Owner for review.

B. All schedule calculation rules, auto cost rules and resource calculation rules shall be in a format acceptable to OAR. When schedule calculations are performed, the “Retained Logic” setting shall be used. CONTRACTOR shall use the zero “Decimal Places” setting. Finish Milestones shall be constrained with a “Finish on or before” type constraint in accordance with the dates stipulated in Specification Section 01 1219, Phasing of the Work, Appendix A. No “Mandatory Finish” type constraints, no “Zero Free Float” constraints, no special hidden lag time between activities or other “float Suppression”

techniques will be permitted. A schedule milestone constraint extending beyond Contract time or less than Contract time will not be acceptable. Rather, CONTRACTOR shall show any unused contract time as float (slack time) available to the project.

PART 3 –EXECUTION

3.01 SCHEDULER QUALIFICATIONS

A. CONTRACTOR shall have a scheduler with a minimum of 5 years direct experience in the development and maintenance of schedules.

B. CONTRACTOR shall submit the resume of the construction scheduler to OWNER for review and approval. OAR has the right to refuse to accept the Scheduler based upon a lack of experience as required by this Section or based on lack of on-site performance and timeliness of schedule submittals. If OAR does not accept the proposed Scheduler, CONTRACTOR shall within one week of disapproval, propose another Scheduler who meets the experience requirements stated above.

3.02 PRE-CONSTRUCTION SCHEDULING CONFERENCE

A. CONTRACTOR and CONTRACTOR Scheduler shall attend a pre-construction scheduling conference with OAR within 7 days after Notice of Award. CONTRACTOR Scheduler shall develop a construction schedule in accordance with this Specification Section. Scheduler shall cooperate with OAR and shall make themselves available for on-site meetings to develop, monitor, maintain and update the schedule in a timely manner.

3.03 SUBMITTALS

A. Within seven calendar days after the effective date of the Notice to Proceed (or as stipulated in the milestones under Section 01 1219 Phasing of the Work Appendix A), CONTRACTOR shall submit to OWNER for review, a detailed Baseline Construction Schedule setting forth all requirements for complete execution of the Work. Include individual activities for the preparation of specific submittals, activities for owner review periods, activities for the procurement / fabrication period, installation activities, any applicable start-up & testing activities, and all contract milestones. With the exception of submittals and fabrication /procurement activities, each work activity shall range in duration from 1 workday minimum to a 10 workday maximum. The Scheduling system shall indicate all inter-relationships (logic ties) between the activities and shall be logically tied to all relevant milestones listed in Section 01 1219 Phasing of the Work Appendix A. CONTRACTOR shall cost load the activities with a “budgeted cost” that totals up to the Contract award value. The format shall be coordinated with Specification Section 01 2973 (Schedule of Values), Specification Section 01 3229 (Project Forms), and Specification Section 01 2976 (Progress Payment Procedures).

B. The level of detail indicated in the schedule shall be greater than that provided by Section 00 0110: Table of Contents of Contract Technical Specifications, including any Section 00 9113: Addenda. Duration and events indicated on schedule shall conform to phasing set forth in Section 01 1216 Phasing of the Work and shall show any area or building within a particular phase. Each activity description shall outline the specific work scope

(by trade) and the location. Schedule shall indicate any and all Contract "milestone events" and other milestones agreed to by OWNER, but no other manually-imposed dates will be accepted unless approved by OWNER.

C. CONTRACTOR shall allow for inclement weather in the Proposed Baseline Schedule by incorporating an activity titled “Rain Day Impact Allowance” as the last activity prior to the Substantial Completion Milestone. No other activities may be concurrent with it. The duration of the Rain Day Impact Allowance activity will be based on Table #1 below, and will be calculated from the Notice to Proceeed until the original date of Substantial Completion.

Table #1: Cumulative Calendar Days “Rain Day Impact Allowance”:

January	6	July	0
February	5	August	0
March	5	September	1
April	4	October	1
May	1	November	3
June	0	December	5

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

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

D. Activity Codes: As a minimum, the Activity Codes shown in the Table 1 below shall be assigned to each activity.

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

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

E. CONTRACTOR shall submit a color bar chart of all activities organized by Area (Location) and sorted by early start date in a graphically "left to right" manner. In addition, submit a Critical Path (Longest Path) color bar chart filter. Include the following column headings on the left hand side of both bar chart reports: activity ID, activity description, original duration, remaining duration, percent complete, start date, finish date, total float (slack time), and budgeted cost. CONTRACTOR shall also include an electronic file in its original format of the schedule. The electronc P6 file shall be saved in "XER" type format (version 15.1).

F. Include a written schedule narrative sufficiently comprehensive to explain the basis of the CONTRACTOR'S approach to work. The written schedule narrative should include a paragraph of the project's Critical Path, the anticipated crew sizes (by trade), any planned equipment needed, a discussion on any long lead procurement/fabrication items, and any site logistic challenges.

G. Seven calendar days after receipt of the OWNER'S review comments, CONTRACTOR shall revise & re-submit the Construction Schedule acceptable to OWNER. Once the Baseline Construction Schedule is approved, no changes will be allowed unless authorized by the OWNER.

H. Failure of CONTRACTOR to submit a Construction Schedule in full compliance with the Contract Documents will result in a delay in progress payment processing. The Construction Schedule is to be used in evaluating progress and for monthly payment approval.

I. Subsequently with each Monthly Progress Payment Request, CONTRACTOR shall deliver to OWNER a Monthly Schedule Update reflecting Work progressed to the end of the Progress Payment Request period (set as the last day of the month). Each such Monthly Schedule Update shall indicate actual progress to date in execution of the Work, together with a projected schedule for completion of all the remaining Work. CONTRACTOR shall copy & re-name the schedule file each month, status the activities with actual start and/or finish dates, adjust remaining durations, add re-submittals (if applicable), calculate the schedule with a "data date" to the end of the pay period, and

submit the required reports outlined in Article 3.03 to OWNER. Each Monthly Schedule Update shall be submitted con-currently with the Monthly Pay Application no later than the fifth day of the succeeding month in accordance with Article 14 of the General Conditions. In updating the Schedule, CONTRACTOR shall not modify Activity ID numbers, activity descriptions, original durations, logic, schedule calculation rules/criteria, or the Activity Coding unless authorized by the OAR.

J. All Schedule submittals are subject to review and acceptance by OWNER. OWNER retains the right to withhold progress payments in whole (or in part) until CONTRACTOR submits a Construction Schedule acceptable to OWNER.

3.05 FOUR-WEEK ROLLING SCHEDULE

A. At each Weekly Progress Meeting, CONTRACTOR shall present a Four-Week Rolling Schedule in Bar Chart format. It shall show one (1) week of actual and three (3) weeks of forecasted progress. The Four-Week Rolling Schedule shall be used as a basis for discussing progress and work planned during the three (3) weeks.

1. The Four-Week Rolling Schedule shall be based on the most recent OAR Accepted Monthly Schedule Update. It shall include weekly updates to all construction, submittal, fabrication and procurement, and separate work contract activities. CONTRACTOR shall ensure that it accurately reflects the current progress of the Work.

2. CONTRACTOR shall discuss at the Weekly Progress meeting the actual dates and any variances to critical or near critical activities.

3. Upon request by OAR, CONTRACTOR shall provide the Four-Week Rolling Schedule in electronic format.

4. If the Four-Week Rolling Schedule indicates activities are behind schedule, CONTRACTOR shall provide a Recovery Schedule in accordance with Article 3.06 below.

5. If the CONTRACTOR chooses to provide a Four-Week Rolling Schedule in a greater level of detail (by trade/subcontractor) outside of the monthly schedule database, then upon CONTRACTOR REQUEST and OAR written approval, the CONTRACTOR may proceed as long as the detailed activities roll-up to the contractual monthly schedule updates. These detailed activities will need to be linked to the overall Substantial Completion date as to properly forecast whether the project is ahead or behind schedule during the weekly Progress Meetings. The Four-Week Rolling Schedule must accurately reflect the work that is going on during the current week and must accurately reflect what will happen in the next three weeks.

3.06 RECOVERY SCHEDULES

A. If a Monthly Schedule Update indicates negative float greater than ten (10) days on a critical path as result of events not predicated by Articles10 and 12 of the General Conditions, CONTRACTOR shall prepare a Proposed Recovery Schedule demonstrating CONTRACTOR'S plan to regain the time lost. The Recovery Schedule shall be

submitted either in advance of or concurrent with the Monthly Schedule Update and CONTRACTOR progress request. Both the Monthly Schedule Update and the Proposed Recovery Schedule shall be based on the same percentages of completion and actual dates accepted by OAR under Article 3.03.

B. The Proposed Recovery Schedule shall be based on a copy of the Monthly Schedule Update for the calendar month during which the negative float first appears.

C. The Proposed Recovery Schedule shall include a written narrative that identifies the causes of the negative float on the critical path and provides CONTRACTOR'S proposed corrective action to ensure timely completion of all Milestones and the Substantial Completion Date. CONTRACTOR'S corrective actions shall include but are not limited to increasing concurrent operations, increasing labor, adding multiple shifts in a 24-hour period, and adding overtime.

D. During any period of time when CONTRACTOR is found to be behind schedule by OAR, the Monthly Schedule Update described above shall become a weekly requirement (at no additional cost to OWNER) to provide a greater degree of focus on the timely completion of the Work. These Updates shall be submitted to OAR every Monday morning. When CONTRACTOR is deemed by OAR to be back on schedule, CONTRACTOR may revert to submitting the schedule monthly.

E. CONTRACTOR'S progress payment may not be processed until OAR accepts the Proposed Recovery Schedule. Following such an acceptance, the Proposed Recovery Schedule will be known as the Recovery Schedule and future Work will be performed by CONTRACTOR in accordance with it.

3.07 FRAGNETS AND TIME EXTENSION REQUESTS

A. Float is not for exclusive use or benefit of either OWNER or CONTRACTOR but is an expiring resource available to both parties on a non-discriminatory basis. If required to meet specified Milestones, either party may utilize float. Adjustments to Milestones or Contract Time will only be authorized by Change Order and only to the extent the claimed adjustments exceed total float along the most critical path of the current Monthly Schedule Update in effect at the time of the claimed adjustments. The claimed adjustments to the Milestones and/or Contract Time must also cause the Substantial Completion Date to exceed that currently indicated in the Monthly Schedule Update. No time extensions will be granted nor delay damages paid under contract until all available float is used and the CONTRACTOR obtains a Time Extension Request approval from the OAR in accordance with Article 1.12 in its entirety. CONTRACTOR claimed adjustments to an existing negative float path will not receive consideration until the activity with the highest negative float is driven even further negative.

1. Claimed adjustments to the Milestones or Contract Time will be administered in conjunction with those set forth in the General Conditions.

B. Pursuant to the float sharing requirements of this Section, the use of float suppression techniques such as preferential sequencing or logic, special lead or lag logic restraints, and extended activity times or durations are prohibited. The use of float time disclosed or implied by the use of alternate float suppression techniques shall be proportionally shared to benefit OWNER and CONTRACTOR. The use of any technique solely for the

purpose of suppressing float will result in OWNER rejection of the submitted Monthly Schedule Update.

C. In the event CONTRACTOR believes the Project has suffered an adverse impact arising from events predicated by Articles 10 and 12 of the General Conditions, CONTRACTOR may prepare a Time Extension Request by submitting a Schedule Fragnet and a written narrative outlining the detail of the impact. A Schedule Fragnet must demonstrate a critical path delay. Such a delay must adversely impact the Substantial Completion Date for CONTRACTOR to receive a time extension. To demonstrate such an impact successfully, CONTRACTOR shall prepare a Schedule Fragnet based on a copy of OWNER accepted Monthly Schedule Update for the calendar month during which the adverse impact occurred. This "copy" of the OWNER accepted Monthly Schedule Update shall however first be updated (by OWNER and CONTRACTOR jointly) with both Percentages of Completion and Actual Dates up to the day the delay commenced. This process will provide the "pre-delay" project status. Once OWNER and CONTRACTOR have agreed to the "pre-delay" project status, CONTRACTOR should make a copy of this "pre-delay" schedule and this copy is to be the starting point for CONTRACTOR'S Schedule Fragnet development. OWNER will evaluate the activities, logic, durations, etcetera, in the Schedule Fragnet and will evaluate if the adverse impact arose from events described by Articles 10 and 12 of the General Conditions. The Fragnet shall also include CONTRACTOR-caused delays that affect the critical or near critical path in the network and should be accounted for in the Time Impact Analysis if overlapped at any point in time with OWNER-caused delay. If rain impact days were granted between the Start and Finish of OWNER-caused delay period, they should be accounted for in the Time Impact Analysis as well. Provided OWNER determines such an impact occurred, CONTRACTOR may be due a time extension equal to the number of proportioned days of variance/delay that resulted to the Substantial Completion Date.

D. Activities added into a Schedule Fragnet to demonstrate the impact of adverse event shall be assigned a unique activity code. The Schedule shall be organized by this unique activity code.

E. The Schedule Fragnet shall incorporate logic ties that are accurately reflective of the adverse event to pre-event predecessor activities and post event successor activities.

F. The format and components of a Schedule Fragnet submittal shall be in accordance with this Section and Articles 10 and 12 of the General Conditions. It is crucial for the Fragnet to be submitted within the same month of discovery so it can be resolved during the monthly schedule update review. The notice shall be transmitted to OAR within the stipulations outlined in Article 12 of the General Conditions.

G. If OWNER accepts CONTRACTOR'S Schedule Fragnet and an extension is granted, a Change Order will be prepared. OWNER will advise what change order number the time extension will become. When CONTRACTOR receives this Change Order number, all the activities added to the Schedule Fragnet shall be given Activity Identification Numbers that corresponds with the Change Order number. CONTRACTOR shall cost load the activities if required by OWNER. If resource loading is required, the resource loading shall include a breakdown of labor, material, and equipment quantities.

H. If OWNER rejects CONTRACTOR'S Schedule Fragnet in part based on improper forecast logic or activity tasks then it shall be revised accordingly to conform to OWNER'S review comments and be re-submitted. If the forecast logic and activity tasks cannot be agreed to then the pre-delay schedule outlined in Article 3.07, C shall be

compared to the actual as-built data in the succeeding month of the encountering issue, event, condition, circumstance, and/or cause. The variance to the project between the pre-delay and post delay schedules shall be discussed in CONTRACTOR'S written narrative and proportioned between the different parties involved in the delay.

I. If OWNER rejects CONTRACTOR'S Schedule Fragnet in whole then CONTRACTOR may follow the procedures set forth in Article 16 of the General Conditions.

3.08 PAYMENT FOR SCHEDULING

A. The Work of this Section will be included as part of the bid price.

B. Preparation, revising, maintenance, and compliance with this Section and Section 01 2973 is an integral part of the Contract Documents and is specified to have a minimum value equal to 2 percent of the original Contract Amount. This amount shall be proportionally cost loaded into two activities in both the Proposed Baseline Schedule and the Schedule of Values described in Section 01 2973. One activity for the "Baseline Schedule" and the other activity for the "Monthly Schedule Update Process" as follows:

1. CONTRACTOR may allocate thirty percent (30 percent) of the total scheduling cost and place in the "Baseline Schedule" activity. It can then be billed against when the OAR accepts the Proposed Baseline Schedule as the Baseline Schedule.

2. The remaining seventy percent (70 percent) may be cost loaded into the "Monthly Schedule Update Process" activity. This amount may be billed in equal monthly increments. The amount of those increments is determined by dividing the remaining cost by the total number of months in the Contract Time. Payment of these incremental amounts is contingent upon OAR acceptance of CONTRACTOR Monthly Schedule Updates, Recovery Schedules, Four-Week Rolling Schedules, Fragnets, Time Impact Analysis, and the updated Log of Required Submittals.

3. The CONTRACTOR shall anticipate in their base contract scope that numerous Fragnets and written time impact analyses will be required during the duration of the project with the Monthly Schedule Updates. Requests for extra scheduling services will not be considered until the CONTRACTOR demonstrates that all of the costs stipulated in Article 3.08, B has been expended.

3.09 FAILURE TO COMPLY WITH REQUIREMENTS

A. At any time during the project if CONTRACTOR fails to comply with the specified requirements, OWNER reserves the right to engage independent estimating and scheduling consultants to fulfill these requirements. Upon notice to CONTRACTOR, OWNER shall assess against CONTRACTOR, incurred costs for these additional services.

B. In such an event, OWNER will require, and CONTRACTOR shall participate and provide requested information to ensure the resulting Milestones Schedule accurately reflects CONTRACTOR's plan to execute the Work in compliance with the Contract Documents. If it becomes necessary for OWNER to recommend logic or duration revisions as a result

of CONTRACTOR failure to furnish acceptable data, and if CONTRACTOR has objections to the recommendations, CONTRACTOR shall provide notice to OWNER within three days and CONTRACTOR shall provide an acceptable alternate plan. If CONTRACTOR fails to so note any objections and provide an acceptable alternate plan, or if CONTRACTOR implements the recommendations of OWNER without so noting any objections, CONTRACTOR will be deemed to have waived all objections and concurred with the recommended logic/duration revisions provided by ARCHITECT and/or OWNER.

C. Submittal of any Monthly Schedule Updates are subject to review and acceptance by OWNER. OWNER retains the right, including, but not limited to Article 14 of the General Conditions, to withhold progress payments in whole or part until CONTRACTOR submits a Monthly Schedule Update acceptable to OWNER. If a Monthly Schedule Update is "Rejected" due to the OWNER not receiving a satisfactory schedule that accurately reflects the on-going work activities, the OWNER will mandate a separate meeting with the CONTRACTOR and approved Scheduler to remedy the non-conformance. If after the 2nd consecutive month the OWNER still has to "Reject" the monthly Schedule update due to non-conformance, then the CONTRACTOR'S Scheduler will need to be replaced at no additional cost to the OWNER. CONTRACTOR shall within one week of disapproval, propose another Scheduler who meets the required experience.

3.10 CONTRACTOR RESPONSIBILITY

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

B. CONTRACTOR shall provide at all times sufficient competent labor, materials, and equipment to properly carry on Work and to insure completion of each part in accordance with Construction Schedule and within time agreed. CONTRACTOR shall involve the subcontractors, manufacturers, and suppliers in the development and periodic updating of the schedule.

3.11 RECORD DOCUMENTS / FINAL AS-BUILT SCHEDULE

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

END OF SECTION

SECTION 01 3229

PROJECT FORMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The following, but not limited to, administrative forms and documents listed in this Section are to be utilized in the administration of the Work. Upon CONTRACTOR request, OAR may approve the use of alternate forms. Electronic versions of these forms are available on the LAUSD website.

B. From time to time, OWNER may release new revisions and new Project Forms. At any time during the Project, if requested by OAR, CONTRACTOR shall use the newly released Project Forms.

1.02 RELATED REQUIREMENTS

A. Division 01: General Requirements.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 FORMS

A. The following examples of forms are contained within this Section:

1. Allowance Disbursement Authorization.

2. Application for Payment (2 pages)[1].

3. Certification of Compliance with Project Stabilization Agreement and Labor Compliance.

4. Certification of Compliance with CEQA Mitigations.

5. Certificate of Substantial Completion.

6. Change Order.

7. Change Order Proposal.

8. Change Order Proposal – Compensable Delay Costs.

[1] Application for Payment (Multiple Projects Form) is available from the OAR.

9. Change Order Proposal Detail Sheet.

10. Change Order Proposal Guidelines.

11. Change Order Proposal – Labor Rate Calculation Form (Request for Rate Higher Than Fully burdened Labor Rates).

12. Conditional Waiver and Release – Final Payment.

13. Construction Directive.

14. Correction Notice.

15. Daily Construction Report.

16. Daily Time and Material Record.

17. Initial Notice of start of Issue. Event, Condition, Circumstance, or Cause of Perceived or Actual Delay, Disruption, Interference, Condition, Circumstance, or Cause of Perceived Delay, Disruption, Interference, Hindrance, Acceleration.

18. Final Notice of End of Issue, Event, Condition, Circumstance, or Cause of Perceived or Actual Delay, Disruption, Interference, Condition, Circumstance, or Cause of Perceived Delay, Disruption, Interference, Hindrance, Acceleration.

19. Five Day Notice.

20. List of Subcontractors.

21. Notice of Completion.

22. Notice of Partial Use or Occupancy.

23. Notice of Termination.

24. Notice to Proceed.

25. “Or Equal” Request.

26. OWNER Assessment Summary.

27. Property Inventory.

28. Request for Certification of Substantial Completion.

29. Request for Clarification.

30. Request for Proposal.

31. Request for Reduction of Retention.

32. Schedule of Values.

33. Storm Water Pollution Prevention – Site Monitoring Report.

34. Submittal Log.

35. Substitution Request.

36. Survey of Existing Site Conditions.

37. Transmittal.

3.02 PROCEDURES

A. Allowance Disbursement Authorization: This form is used for the request and approval of Contract allowances.

B. Application for Payment: This form is used in requesting a progress payment.

C. Application for Payment (Multiple Projects): Alternate progress payment request form for contracts comprising more then one project.

D. Certification of Compliance with Project Stabilization Agreement and Labor Compliance Code Section 1776: This form is used to certify that all contributions due and owing to appropriate trust funds have been paid by CONTRACTOR and all Subcontractors, as specified by the Project Stabilization Agreement (PSA) and General Conditions Article 6.49. This form is also used to certify that CONTRACTOR has submitted all certified payroll records mandated by Labor Code 1776, and General Conditions Article 6.49.

E. Certification of Compliance with CEQA Mitigations: This form is used to certify that all CEQA requirements were complied with by CONTRACTOR.

F. Certificate of Substantial Completion: This form is used according to Article 14 of the General Conditions.

G. Change Order: This form is used to adjust the Contract Amount, Milestones or Contract Time.

H. Change Order Proposal: This form is used to communicate proposed adjustments to the Contract Amount, Milestones or Contract Time.

I. Construction Directive: This form is used to issue a Construction Directive.

J. Correction Notice: This form is used to provide notice of defective Work.

K. Daily Construction Report: This form is used to report daily Work activities and manpower levels of CONTRACTOR or Subcontractor.

L. Daily Time and Material Record: This form is used to provide daily records as set forth in Article 11.11 of the General Conditions.

M. Initial Notice of Start of Issue, Event, Condition, Circumstance, or Cause of Perceived Delay, Disruption, Interference, Hindrance, Acceleration: This form is used to provide notice as set forth in Article 12.2.1 of the General Conditions.

N. Final Notice of End of Issue, Event, Condition, Circumstance, or Cause of Perceived Delay, Disruption, Interference, Hindrance, Acceleration: This form is used to provide notice as set forth in Article 12.2.2 of the General Conditions.

O. Five Day Notice: This notice is used according to Article 15.3.2 of the General Conditions.

P. List of Subcontractors: This form is used according to Article 14.2 of the General Conditions.

Q. Notice of Completion: This form is used according to Article 14.17 of the General Conditions.

R. Notice of Partial Use or Occupancy: This form is used according to Article 14.15 of General Conditions.

S. Notice of Termination: Contractor shall submit a Notice of Termination (NOT) to the Los Angeles Regional Water Quality Control Board, LARWQCB. Provide a copy of NOT to OAR (See Section 01 7416).

T. Notice To Proceed: This form is used to establish the date of Contract Time commencement and the date Contractor is authorized to commence performance of Contractor obligations.

U. “Or Equal” Request: This form is used to submit a list of proposed “or equal” substitutions.

V. Owner Assessment Summary: This form is used for all assessments or withholds by the Owner, permitted under the Contract or required by law, including without limitation, stop notices, prevailing wage violations, liquidated damages, additional consultant services, OCIP premiums, etc.

W. Property Inventory: This form is used to establish Owner property in a space.

X. “Request for Certification of Substantial Completion”: This form is used according to Article 14 of the General Conditions

Y. Request for Clarification: This form is to be used for clarification of the intent of the Contract Documents.

Z. Request for Proposal: This form is used to request a proposed adjustment in the Contract Amount, Milestones or Contract Time in response to the Work contained within the Request for Proposal.

AA. Request of Reduction of Retention: This form is used according to Article 14.8 of the General Conditions.

BB. Schedule of Values: This form is used to establish the basis of the certified Application for Payment.

CC. Storm Water Pollution Prevention Plan (SWPPP): Site Monitoring Reports: These forms are used to certify that construction activities are in compliance with SWPPP (see Section 01 7416).

DD. Submittal Log: This form is a format for the listing of the required submittals.

EE. Substitution Request: This form is used to submit proposed substitutions of materials or equipment no longer manufactured or which cannot be acquired from existing inventories.

FF. Transmittal: This form is used for transmission of items related to the Contract.

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, OAR and others.

1.02 RELATED REQUIREMENTS

A. Section 01 1216: Phasing of the Work.

B. Section 01 2513: Product Substitution Procedures.

C. Section 01 2973: Schedule of Values.

D. Section 01 2976: Progress Payment Procedures.

E. Section 01 3113: Project Coordination.

F. Section 01 3216: Construction Schedule.

G. Section 01 3229: Project Forms.

H. Section 01 4523: Testing and Inspection.

I. Section 01 4525: Testing, Adjusting, and Balancing for HVAC.

J. Section 01 5000: Construction Facilities and Temporary Controls.

K. Section 01 7123: Field Engineering.

L. Section 01 7329: Cutting and Patching.

M. Section 01 7416: Storm Water Pollution Prevention.

N. Section 01 7700: Contract Closeout.

O. Section 01 7836: Warranties.

PART 2 – PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 PROCEDURES

A. CONTRACTOR is required to review and approve every submittal and shop drawing prior to transmittal and delivery to ARCHITECT. Should CONTRACTOR determine a submittal contains errors, or does not meet the requirements of the contract, CONTRACTOR shall immediately return the submittals and shop drawings to the producer and expedite the corrections prior to transmitting the submittal to ARCHITECT. Submittals shall not be used by CONTRACTOR to request clarifications or submit questions. CONTRACTOR will affix stamp to each submittal certifying CONTRACTOR has performed, at minimum, the following:

1. Verified the submittal is complete in all respects and follows the requirements of the Contract Documents without variance.

2. Confirmed that no substitutions have been included. If substitutions are included, CONTRACTOR shall eliminate them from the submittal and process them in accordance with Section 00 7000 General Conditions Article 6.14.

3. Identified any variances from the requirements of the Contract Documents and confirmed that the identified variance meets, but does not exceed the allowable limitations or tolerances as defined in these specifications.

4. Verified that all submitted materials, dimensions and tolerances are compatible with existing or planned conditions of the Work in order to erect, fabricate, or install the submitted assembly in conformance with the requirements of the Contract Documents.

5. Coordinated and verified that the dimensions match CONTRACTOR measured field or installation conditions.

6. Coordinated and verified that the products of separate manufacturers required within any field produced assembly are compatible in all respects for such assembly.

7. Packaged together all related submittals or shop drawings where such is necessary for a comprehensive ARCHITECT review.

B. CONTRACTOR shall package each submittal appropriately for transmittal and handling. Transmittal format shall be as required by OWNER. CONTRACTOR shall transmit and deliver six sets of each submittal or re-submittal to ARCHITECT, two of which shall be returned to CONTRACTOR. Some specifications may require additional copies be

provided. CONTRACTOR shall provide the OWNER additional copies as specified or as requested by OAR. ARCHITECT will not accept submittals received from sources other than from CONTRACTOR.

C. After ARCHITECT'S review, ARCHITECT will transmit submittals to OAR and OAR shall further distribute to CONTRACTOR, INSPECTOR and others as required. Work shall not commence, unless otherwise approved by OAR, until approved submittals are transmitted to CONTRACTOR.

D. CONTRACTOR shall clearly identify any deviations from the Contract Documents on each submittal. Any deviation not so noted even though stamped reviewed is not acceptable.

E. CONTRACTOR shall coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities requiring sequential activity.

F. Timing of Submittals:

1. In accordance with General Conditions, CONTRACTOR shall submit to ARCHITECT, with copy of transmittal to the OAR, those Shop Drawings, Product Data, diagrams, materials lists, Samples and other submittals required by the Contract Documents.

2. The scheduling of submittals shall be sequenced to support the progress of the Work, and shall be:

    a. Submitted sufficiently in advance of construction, fabrication or installation in order to allow time for transmittal, review, modification, correction, (and resubmission and re-review when required.)

    b. Phased with adequate time between submittals in order to allow for proper review by the ARCHITECT without negative impact to the Milestones Schedule.

3. CONTRACTOR shall coordinate submittal of related items and ARCHITECT reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received by ARCHITECT.

4. CONTRACTOR shall revise, update and submit submittal schedule to ARCHITECT and OAR on the first of each month, or as required by OAR.

5. CONTRACTOR shall allow in the Construction Schedule, at least 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 OAR, 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 OAR).

3.03 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of Work or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, wiring diagrams, schedules, illustrations, or performance curves.

1. Mark each copy to show or delineate pertinent materials, products, models, applicable choices, or options. Where Product Data includes information on several products that are not required, clearly mark copies to indicate the applicable information. Include the following information:

    a. Manufacturer's printed recommendations.

    b. Compliance with 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 OAR for review and selection.

4. Number Required: Submit six, minimum, of each. Two will be returned to CONTRACTOR.

B. When specified, erect field Samples and mock-ups at the Project site to illustrate products, materials, fabrications, or execution and to establish standards by which completed Work shall be judged.

C. Maintain sets of Samples, as returned, at the Project site, for quality comparisons throughout the course of the Work. Sample sets may be used to obtain final acceptance of the Work associated with each set.

3.05 QUALITY CONTROL SUBMITTALS

A. Submit quality control submittals, including design data, certifications, manufacturer's field reports, and other quality control submittals as required under other sections of the Contract Documents.

B. When other sections of the Contract Documents require manufacturer's certification of a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.

C. Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the represented company.

D. Requirements for submittal of inspection and test reports are specified in other sections of the Contract Documents.

END OF SECTION

SECTION 01 3546

INDOOR AIR QUALITY PROCEDURES

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. CONTRACTOR's requirements and actions to ensure that the building and the mechanical system are free of Volatile Organic Compounds (VOCs), moisture, dust, mold, and microbes prior to achieving Substantial Completion.

2. CONTRACTOR requirements for temporary construction ventilation, dust protection, preconditioning of materials, protection of materials, sequencing, and duct protection.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 01 1216 - Phasing of the Work.

3. Section 01 4525 - Testing, Adjusting, and Balancing for HVAC.

4. Section 01 5000 - Construction Facilities and Temporary Controls.

5. Section 01 6000 - Product Requirements.

6. Section 23 8826 – Split System Air conditioners

C. Referenced Standards:

1. ASHRAE 62.1, Ventilation for Acceptable Indoor Air Quality.

2. ASHRAE 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

D. VOC-Emitting Materials. Related Sections:

1. Section 07 9200 - Joint Sealants.

2. Section 09 2900 - Gypsum Board.

3. Section 09 9000 - Painting and Coating.

1.02 SUBMITTALS

A. CONTRACTOR shall develop and submit to the OAR for review and approval a Construction Indoor Air Quality (IAQ) Plan using the blank form provided after the end of this Section. Plan shall be submitted within 120 days of Notice to Proceed (NTP). Implementation of the approved IAQ Plan shall be included in the project Construction Schedule.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.01 QUALITY CONTROL

A. CONTRACTOR shall conduct inspections to confirm that measures proposed in the Construction IAQ Plan are followed during construction and shall report on the progress of the Plan during the progress meetings described in Section 01 3119: Project Meetings.

3.02 PROJECT CONDITIONS

A. During construction, prior to Substantial Completion and Building Flush Out, systems designed with particle filters shall not be operated at any time without filters in place. Filters used during construction shall have a minimum rating of MERV 8. Following construction completion, replace filters per Section 23 8826 – Split System Air conditioners.

B. Following completion of building envelope maintain continuous Temporary Construction Ventilation of interior areas where VOC-Emitting Materials and VOC-Emitting Furnishings and Equipment, identified in Paragraphs 1.01.D and 1.01.E of this Section, areas are installed.

1. Temporary Construction Ventilation may be supplied via the building's HVAC system and shall comply with the following requirements:

   a. Return air grilles shall be sealed or temporary MERV 8 air filters shall be installed.

   b. Provide MERV 8 air filters to filter the outside air.

   c. Provide a minimum of three air changes per hour of outside air while maintaining the building interior temperature between 60 degrees F and 85 degrees F with the relative humidity not to exceed 60 percent.

2. The Temporary Construction Ventilation specified requirements for building interior temperature and/or relative humidity may be exceeded only when the building HVAC unit is operating at 100 percent capacity.

3. Temporary Construction Ventilation may be supplied via temporary ducts and fans, sufficient to provide no less than three air changes per hour and exhausted directly to the outside/outdoors while maintaining the building interior temperature between 60 degrees F and 85 degrees F with the relative humidity not to exceed 60 percent.

4. Maintain continuous Temporary Construction Ventilation for a minimum period of 72 hours after installation of the VOC-Emitting Materials unless otherwise indicated elsewhere in these Specifications.

C. Temporary Construction Ventilation shall be provided for post-building-flush-out, post-occupancy touch-up, or punch list activities involving VOC-Emitting materials. Touch-up activities involving VOC-Emitting Materials shall not occur when students or staff are present.

D. Prior to installation, allow VOC-Emitting Furnishings and Equipment, identified in Paragraph 1.01.E of this Section, to off-gas in dry, well-ventilated space for 14 calendar days.

1. Remove containers and packaging to maximize off-gassing of VOCs.

2. Precondition products in ventilated warehouse or other ventilated building. Preconditioning at the project site is acceptable, provided that Temporary Construction Ventilation and Sequencing measures are taken as described in Paragraph 3.02.B and Article 3.03 of this Section.

3. Products requiring preconditioning include, at a minimum, VOC-Emitting Furnishings and Equipment that contain vinyl or other flexible plastics, resins, adhesives, foam rubber, and fiberboards with urea-formaldehyde binders. Products bearing CHPS-approval as low- emitting materials GREENGUARD Certification, Indoor Advantage Gold Certification, Green Label Plus Certification, or other OWNER-approved certification shall be excluded from this preconditioning requirement.

3.03 SEQUENCING

A. Where VOC-Emitting Materials identified in Paragraph 1.01.D of this Section are applied on-site, apply the VOC-Emitting Materials prior to installation of any Porous and Fibrous Materials identified in Paragraph 1.01.F of this Section. Maintain the continuous Temporary Construction Ventilation requirements described above for a period of 72 hours before installation of porous and fibrous materials.

1. Where this sequencing requirement is not possible, protect porous materials with polyethylene vapor retarders. Tape polyethylene edges to insure a complete seal. Maintain continuous ventilation per temporary construction ventilation requirements described above for a period of 72 hours before removing polyethylene.

B. Completion: Complete interior finish material installation prior To Building Flush-Out as described in Paragraph 3.05.C of this Section.

3.04 PROTECTION

A. Moisture Protection:

1. Protect materials specified in Paragraphs 1.01.D, 1.01.E and 1.01.F of this Section from water intrusion or penetration.

2. Weatherproof enclosures shall be temporarily constructed to store and protect the materials from moisture sources.

3. Materials shall be covered to protect them from rain and other moisture sources and, if resting on the ground, shall use spacers to allow air to circulate between the ground and the materials.

4. Materials including porous or fibrous materials with visible mold and microbial growth shall not be installed.

   a. Non-porous materials with minor visible mold and microbial growth shall be decontaminated.

   b. Structural lumber showing visible signs of mold shall be removed from the project site or be decontaminated, per specification Section 06 1000 - Rough Carpentry, prior to installation.

B. Duct Protection:

1. Seal ducts during transportation and delivery, per Section Section 23 8826 – Split System Air conditioners.

2. Seal ducts during construction to prevent accumulation of dust and debris. If seals must be removed for temporary construction ventilation purposes, they shall be resealed upon conclusion of the required ventilation period. Remove seals prior to HVAC system start-up.

3. During dust producing activities in enclosed buildings, such as drywall installation and finishing, sanding, cutting, or grinding, CONTRACTOR shall turn HVAC ventilation system off and protect HVAC system supply and return openings from dust infiltration. Separate dust-producing activities from the rest of the construction area using plastic sheathing. Provide temporary ventilation.

3.05 CLEANING

A. Just prior to Substantial Completion, vacuum carpeted and soft surfaces with a Green Label certified vacuum.

B. Duct Cleanliness:

1. Before shipment to site ensure ducts are clean and duct openings protected with a self-adhering film, as specified On Section Section 23 8826 – Split System Air conditioners.

2. Just prior to Substantial Completion and prior to using any ducts to circulate air, ensure that the ducts are free of dust and dirt.

C. Building Flush-Out:

1. Building Flush-Out procedures of this Section supersede those described those of Section 01 4525: Testing, Adjusting, and Balancing of HVAC.

2. At construction completion, prior to occupancy and with all interior finishes installed, replace filtration media with new per HVAC equipment schedule and perform a building flush-out. Flush-out shall supply a total air volume of 14,000 cubic feet of

outdoor air per square foot of floor area while maintaining an internal temperature of at least 60 degrees Fahrenheit and relative humidity no higher than 60%.

3. If OWNER elects to partially use and/or occupy the Work prior to completion of the flush-out, the space may be occupied following delivery of a minimum of 3,500 cubic feet of outdoor air per square foot of floor area. Once the space is occupied, it shall be ventilated at a minimum rate of 0.30 cubic feet per minute (cfm) per square foot of outside air. During each day of the flush-out period, ventilation shall begin a minimum of 3 hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14,000 cubic feet per square foot of outside air has been delivered to the space.

4. During building flush-out, when required to perform touch-up or punch list activities involving VOC-Emitting Materials as described in Article 1.01 of this Section, extend Building Flush-Out by a minimum of four days continuously after the touch-up or punch list activities at the maximum tempered outside air rate for 24 hours per day in the space where the touch-up or punch list activities occurred.

5. If Continuous Construction Ventilation is not possible, non-continuous flush-out shall total an equivalent of air as described in Paragraph 3.05-C.2 above.

6. Return ventilation system to normal operation following flush-out period to minimize energy consumption.

END OF SECTION

CONSTRUCTION INDOOR AIR QUALITY (IAQ) PLAN

Contractor shall complete and submit this Plan to the OAR no later than one hundred twenty (120) days after receipt of Notice to Proceed.

GENERAL CONTRACTOR:

Name: _____Title:_____

Telephone: _____Fax: _____

Email: _____

I have read and understood and will implement the following Construction IAQ Plan.

Signature: _____ Date: _____

I. CONSTRUCTION VENTILATION (Per paragraphs 3.02.A through C)

List project materials requiring Construction Ventilation per Part 1 of this Section. Attach additional sheet if necessary. Circle the following Temporary Construction Ventilation approach to be used.	
3.02.B	Ventilation will be supplied via building's HVAC system. • _____Return air grilles are sealed. Exhaust is provided via open windows or doors. OR: • Return air grilles are used for exhaust. HVAC will provide a minimum 35 percent outside air. Air filters with a minimum MERV rating of 8 will be provided at return air grilles. • Building HVAC will be turned off during dust generating activities.
3.02.B.3	Ventilation will be accomplished via open windows, temporary ducts, and temporary fans ducted directly to the outdoors. • Supply air diffusers, return air grilles, and/or open ducts will be sealed. Make-up air will be provided through open windows or doors or other transfer air devices. • HVAC system will provide make-up air. Return air grilles will be sealed.
Required	• Ventilation will provide no less than three air changes per hour. • Ventilation will be continuous for a period no less than 72 hours after completion of

	installation of VOC-emitting materials. • Filters used during Construction Ventilation will be replaced prior to Substantial Completion

II. PRECONDITIONING (Per paragraph 3.02.D)

List project materials requiring Preconditioning per Part 1 of this Section. Attach additional sheet if necessary. Circle the following Preconditioning approach to be used.	
A	Preconditioning will occur in dry and well-ventilated offsite location. Where is the offsite location?
B	Preconditioning will occur onsite. Check the applicable approach. ☐ Ventilation will be supplied via building's HVAC system. See paragraph 3.02.B above. ☐ Ventilation will be accomplished via open windows, temporary ducts, and temporary fans. See paragraph 3.02.B.3 above.
Required	• Containers and packaging will be removed prior to Preconditioning. • Preconditioning will occur for fourteen (14) continuous days prior to installation

III. SEQUENCING (Per Article 3.03)

List project porous and fibrous materials requiring Sequencing consideration per Part 1 of this Section. Attach additional sheet if necessary.	
Required	• Previously installed Porous or Fibrous Materials located in a room where VOC-Emitting Materials are to be installed will be protected with polyethylene vapor retarder. Polyethylene will not be removed until completion of a 72-hour ventilation period. • Installation of interior finish materials will complete fourteen (14) days prior to Substantial Completion

IV. PROTECTION (Per Article 3.04)

List project materials requiring Protection per Part 1 of this Section. Attach additional sheet if necessary.	
Required	• Weatherproof enclosures shall be temporarily constructed to store and protect the materials from moisture sources. Materials shall be covered from rain and other moisture sources and if resting on the ground, use spacers to allow air to circulate between the ground and the materials. • Materials including porous or Fibrous Materials with visible microbial growth shall not be installed. • Materials that are not defined as Porous or Fibrous with visible microbial growth shall be decontaminated prior to installation. Lumber exhibiting a minor amount of "lumberyard mold" need not be discarded. • Temporary ventilation shall be provided during dust producing activities. See Item I Construction Ventilation above. Supply air diffusers and return air grilles shall be covered. • Ducts shall be sealed during transportation, delivery, and construction.

END OF CONSTRUCTION INDOOR AIR QUALITY PLAN

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 2000 – Concrete Reinforcing.

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

3. Section 05 1200 – Structural Steel Framing.

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. Soils:

1. General: Periodic inspection by Geotechnical Engineer for verification of the following construction activities in conformance to CBC Table 1705A.6:

   a. Site has been prepared properly prior to placement of controlled fill and/or excavations for foundations.

   b. Foundation excavations are extended to proper depth and have reached proper material.

   c. Materials below footings are adequate to achieve the design bearing capacity.

2. Compacted Fills: Testing and inspections shall be in conformance to Table 1705A.6:

   a. Geotechnical Engineer will continuously verify the use of proper materials and inspect lift thicknesses, placement, and compaction during placement of fill.

   b. Testing Laboratory under the supervision of the Geotechnical Engineer will:

      1) Perform qualification testing of fill materials.

      2) Test the compaction of fill.

3. Driven Deep Foundations (Piles): Testing and inspections shall be in conformance to Table 1705A.7:

   a. Continuous inspections by Geotechnical Engineer:

      1) Verify pile materials, sizes and lengths comply with the requirements.

      2) Inspect driving operations and maintain complete and accurate records for each pile.

      3) Verify locations of piles and their plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and record any pile damage.

   b. Testing Laboratory under the supervision of the Geotechnical Engineer will determine capacities of test piles and conduct additional load tests as required.

   c. Steel piles: Tests and inspections will be as indicated on paragraphs below for structural steel.

d. Concrete piles and concrete filled piles: Tests and inspections will be as indicated on paragraphs below for concrete.

4. Cast-in-place Deep Foundations (Piers): Continuous inspections by Geotechnical Engineer in conformance to Table 1705A.8:

a. Inspect drilling operations and maintain complete and accurate records for each pier.

b. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, and embedment into bedrock (if applicable). Record concrete or grout volumes.

c. Confirm adequate end strata bearing capacity.

d. Concrete Piers: Tests and inspections will be as indicated on paragraphs below for concrete.

5. Retaining Walls:

a. Continuous inspections by Geotechnical Engineer:

1) Placement, compaction and inspection of soil per CBC Section 1705A.6.1 for fills supporting foundations.

2) Segmental retaining walls; inspect placement of units, dowels, connectors, etc.

b. Concrete Retaining Walls: Provide tests and inspections as indicated on paragraphs below for concrete.

c. Masonry Retaining Walls: Provide tests and inspections as indicated on paragraphs below for masonry.

B. 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. Prestressed Concrete: In addition to the tests and inspections required for concrete listed above, the following tests and inspections will performed:

   a. Testing Laboratory will test prestressing tendons and anchorages per CBC section 1910A.3 and ASTM A370.

   b. Special Inspector will check the materials, equipment, tensioning procedure and inspect placement of prestressing tendons and construction, per CBC section 1705A.3.4.

   c. Special Inspector will verify in-situ adequate concrete strength prior to stressing tendons.

   d. Continuous inspection by Special Inspector of application of prestressing forces and grouting of bonded prestressing tendons, per CBC section 1705A.3.4.

3. Precast Concrete: In addition to the tests and inspections required for concrete listed above, the following tests and inspections will performed:

   a. Continuous inspection by Special Inspector of fabrication of precast concrete members.

   b. Inspection of erection of precast concrete members per ACI 318, chapter 26.8.

4. Shotcrete: In addition to the tests and inspections required for concrete listed above, the following tests and inspections will performed:

   a. Continuous inspection by Special Inspector of placement of shotcrete per ACI 318 section 26.4.5.

   b. Testing Laboratory will test strength of shotcrete in accordance to ASTM C1140 and ASTM C1604.

5. 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.

C. Structural Masonry:

1. Material Verification and Testing:

a. Sampling and testing of reinforcing steel per ASTM A370, DSA IR 17-10 and CBC section 1910A.2. CONTRACTOR shall submit mill certificate indicating compliance with requirements for reinforcement, anchors, ties, and metal accessories.

b. Submit manufacturer's certificate of compliance for masonry units, mortar and grout materials. Test masonry units, mortar and grout (unit strength method).

c. Testing Laboratory will test masonry prisms in conformance with ASTM C1314.

d. Special Inspector will verify proportions of site-prepared, premixed or preblended mortar and grout, per ASTM C780.

e. Testing Laboratory will test core-drilled samples in conformance with CBC 2114.6.2.

2. Inspection:

a. Special Inspector will continuously inspect preparation of prisms per ASTM C1314.

b. Special inspector will verify size, location and condition of dowels and construction supporting masonry.

c. Special inspector will verify size specified size, grade and type of reinforcement.

d. Special inspector will verify weldability of reinforcing bars other than ASTM A706. Special inspector to inspect reinforcing bar welding: Inspection to be in conformance with AWS D1.4, ACI 318 26.5.4.

e. Special inspector will inspect placement of reinforcement, connectors, masonry units and construction of mortar joints.

f. Special inspector will verify protection of masonry during cold weather temperature (temperature below 40^{o} F) or hot weather (temperature above 90^{o} F).

g. Special inspector will inspect type, size and location of anchors and all other items to be embedded in masonry, including other details of anchorage of masonry to structural members, frames and other construction.

h. Special inspector will inspect grout space prior to grouting and placement of grout.

3. Post-installed Anchors in Masonry:

   a. Special inspector will inspect anchors cast in concrete per ACI 318, section 17.8.2.

   b. Special inspector will inspect anchors post-installed in hardened concrete members:

      1) Continuous inspection of adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads, per ACI 318, section 17.8.2.4.

      2) Mechanical anchors and adhesive anchors, not defined in previous paragraph, per ACI 318, section 17.8.2.

   c. Testing Laboratory will test post-installed anchors in conformance to CBC section 1905A and ASTM E488.

D. Structural Steel:

1. Special inspector will verify that all materials are properly marked in conformance with AISC 360, Section 3.3 and applicable ASTM standards.

   a. Mill certificates indicating material properties that comply with requirements.

   b. Materials, sizes, types and grades complying with requirements.

2. Testing Laboratory will test unidentified materials in conformance with ASTM A370.

3. Special inspector will examine seam welds of HSS shapes in conformance with DSA IR-17-3.

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

E. High Strength Bolts:

1. Special inspector will verify identification markings and manufacturer's certificates of compliance conform to ASTM standards specified in the Contract Documents, per DSA IR 17-9.

2. Testing Laboratory will test high-strength bolts, nuts and washers in conformance with ASTM F606, ASTM A370 and DSA IR 17-8.

3. Special inspector will inspect bearing-type ("snug tight") bolt connections in conformance with AISC 360, section M2.5 and DSA IR 17-9.

4. Special inspector will inspect slip-critical bolt connections in conformance with AISC 360, section M2.5.

F. Welding:

1. Verification of Materials, Equipment and Welders:

a. Special inspector will verify weld filler material identification markings per AWS designation listed on the Contract Documents and the WPS.

b. Special inspector will verify material manufacturer's certificate of compliance.

c. Special inspector will verify WPS, welder qualifications and equipment in conformance to DSA IR 17-3.

2. Shop Welding: Special inspector will inspect the following, per CBC 1705A.2.1, AISC 360 (and AISC 341, as applicable) and DSA IR 17-3:

a. Groove, multi-pass fillet welds larger than 5/16", plug and slot welds.

b. Single-pass fillet welds equal or less than 5/16".

c. Inspect welding of stairs and railing systems.

d. Verification of reinforcing steel weldability.

e. Welding of reinforcing steel, per AWS D1.4.

3. Field Welding: Special inspector will inspect the following, per CBC 1705A.2.1, AISC 360 (and AISC 341, as applicable) and DSA IR 17-3:

a. Groove, multi-pass fillet welds larger than 5/16", plug and slot welds.

b. Single-pass fillet welds equal or less than 5/16".

c. End welded studs (ASTM A108) installation, including bend test.

d. Floor and roof deck welds.

e. Welding of structural cold-formed steel.

f. Welding of stairs and railing systems.

g. Verification of reinforcing steel weldability.

h. Inspect welding of reinforcing steel.

4. Non-Destructive Testing: Testing Laboratory will test perform ultrasonic and magnetic particle testing in conformance to AISC 360 section N5.5, AISC 341 appendix Q5.2, AWS D1.1, AWS D1.8, ASTM E543, ASTM E1444, ASTM E164 and DSA IR 17-2.

G. Steel Joists and Trusses: Continuous inspection, special inspector will verify size, type and grade for all chord and web members as well as connectors and weld filler material,

verify joist profile, dimensions and chamber (if applicable); verify all weld locations, lengths and profiles; mark or tag each joist, in conformance with CBC section 2207.1 and DSA IR 22-3.

H. Fire-Proofing:

1. Spray Applied:

a. Project inspector will examine structural steel surface conditions, inspect application, take samples, measure thickness, and verify compliance of all aspects of application with Construction Documents, in conformance with CBC sections and ASTM E.605.

b. Testing Laboratory will test bond strength in conformance with ASTM E605, per CBC section 1705A.14.6.

c. Testing Laboratory will test density in accordance with ASTM E605, per CBC section 1705A.14.5.

2. Intumescent Fire-Resistant Coatings: Special inspector will inspect and test in accordance with AWCI 12-B, per CBC section 1705A.15.

I. 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.

J. Prefabricated Wood Structural Elements:

1. Special inspector will continuously inspect fabrication of glued-laminated timber in accordance with CBC section 1704A2.5.

2. Special inspector will continuously inspect fabrication of manufactured open-web trusses in accordance with CBC 1704A2.5 and DSA IR 23-4.

3. Special inspector will continuously inspect fabrication of manufactured metal plate connected trusses in accordance with CBC 1704A2.5 and DSA IR 23-8.

PART 2 – PRODUCTS (Not used).

PART 3 – EXECUTION (Not used).

END OF SECTION

SECTION 01 5000

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities, construction facilities and temporary controls to be provided, maintained, relocated, and removed by CONTRACTOR.

B. Temporary office furnishings and office equipment.

C. Project signage.

1.02 QUALITY ASSURANCE

A. CONTRACTOR shall comply with applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:

1. Building Code requirements.

2. Division of the State Architect.

3. Health and safety regulations.

4. Utility company regulations.

5. Police, fire department and rescue squad requirements.

6. Environmental protection regulations.

B. CONTRACTOR shall arrange for the inspection and testing of each temporary utility prior to use. Obtain required certifications and permits and transmit to OAR.

C. CONTRACTOR provided facilities are to be in place and available for OWNER use and occupancy within (Insert Number of Days) calendar days following the date of issue of the Notice to Proceed and shall remain in place and available for OWNER use and occupancy throughout the full term of the Contract.

1.03 SUBMITTALS

A. Temporary Utilities: Submit to OAR reports of tests, inspections, meter readings, certifications, permits and similar procedures performed on temporary utilities.

B. Project Signage / Banner: Submit to OAR for review and approval.

1. Shop Drawings: Elevation showing the text, OWNER sign and color of project signage, jointing, fittings and location of grommets.

2. Certification: Submit certification attesting fabric is certified as flame retardant, in accordance to NFPA 701, Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

1.04 PROJECT IDENTIFICATION SIGNAGE AND BANNERS

A. Provide the following project identification information:

1. **"**Your School Bond Funds at Work".

2. "Providing Safe, Updated, and New School Facilities for 21st Century Learning".

3. "Construction Anticipated to Start in XXXX".

4. $XXX Million Investment.

5. "Creates an Estimated XXX Jobs.

6. Name of LAUSD School Superintendent.

7. Alphabetical listing of Board of Education Members.

8. Name of the Architect/Engineer.

9. Name of CONTRACTOR.

10. Name of DESIGN-BUILD TEAM.

B. Project Sign:

1. CONTRACTOR shall furnish and install **[ ]** Project Signs on the Project site at a location established by OAR. For graphical layout refer to Appendix A. OAR will provide the information to be posted on the sign. A draft of the proposed sign shall be submitted to OAR for review and approval before fabrication.

2. Sign shall be direct printed on an aluminum sheet 0.08 thick, adhered to a 3/4 inch thick exterior grade plywood. Electronic file of graphic shall have a minimum resolution of 150 dpi at two feet by four feet. Provide posts, bracing and perimeter framing with intermediate backing not to exceed two feet on center. Size: eight feet wide by four feet high. Size of building rendering shall be approximately six feet wide by three feet high.

C. Banners:

1. CONTRACTOR shall furnish and install [ ] Banners on the Project site at a location established by OAR. For graphical layout refer to Appendix A. OAR will provide the information to be posted on the sign. A draft of the proposed sign shall be submitted to OAR for review and approval before fabrication.

2. Products of the following manufacturers form the basis for design and quality intended: 3M, MACtac North America, or equal, and shall meet the following requirements:

a. Flame retardant, heavy duty durable vinyl material, super smooth, minimum 16 ounces per layer.

b. Banners shall be cut with accurate angles and straight edges. Edges of banner shall be heat welded on four sides without causing fabric separation or otherwise damaging the work.

c. Banners shall have on both sides a clear, permanent, anti-graffiti coating that shall be durable and last a minimum of two years. Cleaning or removal of graffiti shall not cause damage to the anti-graffiti coating or image, or cause it to flake, yellow, bubble, peel or fade.

d. Ink used in the printing process shall be of the highest quality OEM inks and have integral UV protective components.

e. Banners shall be provided with ½ inch diameter grommets along the top and the bottom edges, spaced not more than 30 inches on center. Grommets shall be 4 inches, minimum, from the edges of the banner. Tie wire to fence / barricade.

D. No other signs shall be displayed without approval of OAR. At CONTRACTOR'S expense and without limitation remove and/or relocate Project signage and related facilities as rapidly as required in order to provide for progress of the Work.

E. CONTRACTOR shall remove Project Identification Signage at Substantial Completion of the Work.

1.05 TEMPORARY UTILITIES

A. CONTRACTOR shall coordinate with the appropriate utility company to install temporary services. Where the utility company provides only partial service, CONTRACTOR shall provide and install the remainder with matching compatible materials and equipment.

B. CONTRACTOR shall furnish, install and pay for all necessary permits, inspections, move ins/out, temporary lines, connections and fees, extensions and distribution, metering devices and use charges, deliveries/pickups, rentals, storage, transportation, taxes, labor, insurance, bonds, material, equipment and all other miscellaneous items for the temporary utility systems. CONTRACTOR shall pay to utility companies for the consumption of the following temporary utility services:

1. Temporary Water service.

2. Temporary Electrical service.

3. Temporary Gas service.

4. Temporary Telephone and Data.

C. Maintain, extend and/or relocate temporary utility systems as rapidly as required in order to provide for progress of the Work.

1. Water distribution piping and outlet devices shall be of the size and required flow rates in order to provide service to all areas of the Project site.

2. Furnish, install, maintain, extend and distribute temporary electric area distribution boxes, so located that individual trades can obtain adequate power and artificial lighting, at all points required for the Work, for inspection and for safety.

   a. Provide 20 foot candles minimum lighting levels inside building(s) and 5 foot candles outside for safety and security.

   b. Ensure welding equipment is supplied by electrical generators.

3. Provide temporary Heating, Ventilation and Air Conditioning. OWNER will not accept utilization of the permanent HVAC system for temporary HVAC until Substantial Completion. CONTRACTOR shall maintain manufacturer required levels of room and/or space temperature, humidity and ventilation necessary to install products, materials and/or systems, cure materials, disperse humidity, remove fumes, and prevent accumulation of dust, irritants, or gases.

4. Provide temporary phone, data service and distribution to Project site temporary offices.

D. Upon Substantial Completion of the Work, remove temporary systems, devices and appurtenances.

1.06 TEMPORARY OFFICES

A. CONTRACTOR shall provide Project Site temporary office facilities for his own use, and in addition shall provide and maintain a minimum of one **{insert trailer size} {new}** construction trailer on the Project site for use by OWNER for the duration of the Work. Construction trailer shall be accessible by OWNER and/or INSPECTOR on a 7 day a week 24-hour basis. CONTRACTOR shall provide the necessary materials and labor to provide the trailer with access for disabled persons on request by the OAR. Trailer shall include, at a minimum, the following:

1. Conference room with a table and adequate seating for twelve.

2. One bathroom.

3. An open work area with devising partitions as required by OWNER.

4. Two enclosed, separate offices with windows and lockable doors.

B. Trailer shall be furnished with two exterior entrance doors with one located in a separate office. Each door shall be furnished with ‘Smart Key’ technology on both the dead bolt and cylinder lock. Provide six keys for each locking device. Exterior doors and windows shall be provided with exterior mounted burglar bars. Windows shall be provided with operable window shades. Security of trailer and contents is a continuous obligation of CONTRACTOR and shall be equipped with local sounding security system.

C. Trailer shall have ample headroom, 8-foot minimum, and shall be lighted, heated, ventilated, and air-conditioned. Provide an electrically chilled bottled water fountain of 5-gallon capacity. Purified water shall be supplied in 5-gallon containers, delivered weekly, with four spares on hand after each re-supply visit. As an option, CONTRACTOR may maintain a minimum of two 24 500ml bottles cases of purified water in owner trailer throughout the duration of the project.

D. The separate offices shall each be approximately 120 square feet in size and shall be furnished with a minimum of four 120 volt single phase convenience outlets with one 4' long multi-outlet power strip (such as Legrand Model #PM48C) at each outlet location as well as one telephone jack and one data/LAN outlet. The conference room shall be approximately 200 square feet in size and shall be furnished with a minimum of eight 120 Volt single phase convenience outlets with one telephone jack and one data/LAN outlet.

E. CONTRACTOR shall coordinate floor plan and location of electrical, telephone, data outlets with OAR prior to ordering and delivering the trailer.

F. At CONTRACTOR'S expense and without limitation remove and/or relocate temporary office(s) and related facilities as rapidly as required in order to provide for progress of the Work.

G. CONTRACTOR shall remove waste bin trash from OAR'S trailer, vacuum OAR'S trailer floors and/or mop OAR'S trailer floors once per week. Provide trailer with bathroom paper goods, soap, broom, mop and doormats.

H. Trailer shall remain property of CONTRACTOR. CONTRACTOR shall remove such property upon Substantial Completion of Work or as otherwise determined in writing by OAR.

NOTE TO OAR: FURNISHINGS FOR LARGE PROJECTS SHOULD BE NEW, FOR SMALLER PROJECTS, USED.

1.07 FURNISHINGS

A. CONTRACTOR shall provide **{new}** furnishings in the following quantities, shall set in rooms and shall position as directed by OAR upon delivery:

1. **{Insert quantity}** rolling mid-back task chairs, with arms, Allseating Inertia Mesh Back Basic Synchro Tilt 77089-T2-FM-NSBL-LH-BKN-OG17 Gray Mesh, Gray Matters Enviroleather, warranty 24/7 lifetime, or equal, shall be provided new and shall remain as OWNER's property.

2. **{Insert quantity}** padded meeting chairs, Allseating 77054-NA-GM-FM-NGRY-FV-ARIVR, Gray Matters Enviroleather, warranty 24/7 lifetime, or equal shall be provided new and shall remain as OWNER's property.

3. **{Insert quantity}** desks, 30 by 66 by 30 inches: Haworth Adaptables WURA-3066-LJSC H-AE Graphite worksurface, Haworth Reside Adjustable Hoop Leg ZKH2-3000-PNFD TR-J Graphite (2 per desk), Haworth X Series Pedestal JPMH-24-SJ B/B/F TR-J Graphite (2 per desk), lifetime warranty, or equal, shall be provided new and shall remain as OWNER's property.

4. **{Insert quantity}** metal bookcases, three shelf, 41 by 34 by 12 inches; HON Brigade or equal (Similar to Staples Cat.# 793638; Item: 1598509/ Model: HS42ABCL).

5. **{Insert quantity}** resin folding tables, 29 by 30 by 72 National Public Seating BT3072, 10 year warranty, or equal, shall be provided new and shall remain as OWNER's property.

6. **{Insert quantity}** four drawer, legal size lateral filing cabinet. HON 500 series or equal. (Similar to Staples Item: 342892/Model: HON584L).

7. **{Insert quantity}** four drawer, legal size lateral filing cabinet. HON 320 series or equal. (Similar to Staples Item: 904583/Model: HH324CPP).

8. **{Insert quantity}** five (5) shelf storage/supply cabinet of approximately 78-inch high by 36-inch wide by 24-inch deep, furnished with locking doors, Sandusky or equal. (Similar to Staples Cat. # 880049/Model: SA4R362478-07).

9. Provide and install **{insert quantity}** "Plan-Hold" wall-mounted 42-inch wide plan racks with 36 individual plan holders each.

10. Provide and install **{insert quantity}** large white board in one conference room, 48 by 72 inches, Quartet melamine dry-erase board or equal. (Similar to Staples Cat. # 789834/Model: S538).

11. Provide and install **{insert quantity}** large tack board in the other conference room, 48 by 72 inches, Quartet cork bulletin board or equal. (Similar to Staples Cat. # 789842/Model: QRT2308).

12. Provide and install **{insert quantity}** combination tack/white boards, 36 by 48 inches, one in each office, Quartet or equal. (Similar to Staples Cat. # 518886/Model: S554).

B. Unless otherwise noted in this Section, furniture shall remain property of CONTRACTOR. CONTRACTOR shall remove such property upon Substantial Completion of Work or as otherwise determined in writing by OAR.

1.08 TELEPHONE & DATA AND TRANSMISSION LINES

A. Provide LAN and phone connectivity to all equipment specified below from the point of connection (POC) to equipment, including, but not limited to all cabling, jacks, patch panel, and patch cables as required to connect all of the equipment listed in this section to the LAN. Cabling shall be CAT 6 or better.

B. Provide **{Quantity}** separate phone lines, one dedicated fax line and **{Quantity}** phone instruments each with speakerphone, intercom, conference call, flash, redial, call hold and voice mail. Each phone instruments shall have a 4-line or more capacity/selectivity. Provide supporting terminal blocks and any required switch, router, power supplies, and amplifiers.

C. Provide business class Broadband data service. Broadband data service is defined as a minimum of 200 Mbps download.

D. Provide, install, and maintain the following specified equipment:

1. Cisco ISR 4331 capable of providing wireless Internet access. Smartnet will be provided for the entirety of the project to cover the networking equipment.

2. Cisco Small Business unmanaged switch with enough capacity to provide a wired Ethernet connection to each device in the office capable of using one.

E. Provide, install, configure and maintain **{Quantity}** laptop docking station.

F. Printer/Copier/Scanner/Fax: Provide, install, configure and maintain for network connectivity one HP LaserJet MFP M880z+ (or latest HP equivalent model at time of bid) with the following features and accessories:

1. B/W and Color.

2. Speed:

a. Copy: 46 ppm.

b. Scan: 70 ppm.

c. Print: 46 ppm.

3. Network capable.

4. Finisher with collation and one position stapling (minimum A2W80A HP LaserJet Stapler/Stacker).

5. Three paper trays integral with the equipment including 8 ½ by 11, 8 ½ by 14 and 11 by 17.

6. Additional 3500 sheet paper feed pedestal or drawer.

7. 2 GB Image Memory, 160 GB hard disk drive.

8. 600 by 600 dpi.

9. Zoom, Reduction and enlargement from 25 percent to 400 percent.

10. Embedded Print Controller with minimum 166 Mhz processor and 10/100 BaseT Network Interface Card.

11. 1Fax specifications: See standard for MFP model.

12. Maintenance: CONTRACTOR shall repair and service machine as necessary. Repair calls shall be responded to within 24 hours of placement.

13. Supplies: CONTRACTOR shall provide THE FOLLOWING:

a. All toner supplies and consumables, including enough supplies to maintain two spares of each color toner.

b. All staples and other printer-related consumables, including enough supplies to maintain one spare staple cartridge.

G. CONTRACTOR shall be responsible for maintaining all transmission lines, equipment and related devices. If equipment and/or transmission equipment becomes inoperable and downtime exceeds two days, CONTRACTOR shall replace and/or provide equivalent interim equipment.

H. CONTRACTOR shall employ an experienced and qualified MCSE certified Network Administrator, who shall be responsible to set up and service the LAN equipment and appurtenances provided in OWNER trailer, so as to maintain the equipment in continuous operation. Service response shall be within one day of incident.

I. Electronic/office equipment shall be new at the commencement of the project.

1.09 TEMPORARY STORAGE UNITS

A. CONTRACTOR shall provide secure and waterproof storage units for the temporary storage of furniture, equipment and other items requiring protection.

B. Walls, roof and doors shall be a minimum of 16-gauge steel with floors of 1 inch tongue and groove hardwood or ¾ inch minimum exterior type plywood. The undercarriage shall be designed to accommodate forklift blades 42-inch to 60-inch long. There shall be doublewide swing out lockable doors at one end equipped with waterproof gaskets.

C. CONTRACTOR shall be responsible for delivery charges and will install the storage unit in an appropriate area.

D. CONTRACTOR shall remove the storage unit from the Project site when the storage unit is no longer required for the Work or upon Substantial Completion of the Work.

E. CONTRACTOR shall at their expense and without limitation remove and/ or relocate storage units as rapidly as required in order to provide for progress of the Work.

1.10 TEMPORARY SANITARY FACILITIES

A. CONTRACTOR shall provide portable chemical toilet facilities. Quantity of portable chemical toilet facilities shall be based on total number of workers and shall be in accordance with CAL/OSHA standards.

B. Portable chemical toilet facilities shall be maintained with adequate supplies and in a clean and sanitary condition and shall be removed from the Project site upon Substantial Completion of the Work. CONTRACTOR shall keep both OWNER chemical toilet facilities and OWNER trailer restroom clean and operational at all times.

C. CONTRACTOR employees shall not use school toilet facilities.

D. At CONTRACTOR'S expense and without limitation remove and/or relocate portable chemical toilet facilities as rapidly as required in order to provide for progress of the Work.

E. CONTRACTOR will contain their breaks and lunch periods to the areas designated by OAR or any public area outside the Project site. CONTRACTOR shall provide a suitable container within the break/lunch area for the placement of trash. Areas used for break/lunch must be maintained clean and orderly. Once finish flooring has been installed in a particular area, no food or beverages will be permitted in that area.

1.11 TEMPORARY SECURITY FENCE / BARRICADE

A. CONTRACTOR shall install temporary Project site security barricade(s) indicated on Drawings or as required for safety and as specified herein. New or used material may be furnished. Security of Project site and contents is a continuous obligation of CONTRACTOR.

B. Unless otherwise indicated or specified, security fence shall be constructed of 8-foot high chain link fencing with an 8-foot high windscreen. Space posts not to exceed ten feet on centers. Posts shall be of following nominal pipe dimensions: terminal, corner, and gatepost 2 ½-inch, line posts 2-inch. Chain link fence shall be not less than #13 gauge, 2-inch mesh, and in one width. Posts, fence and accessories shall be galvanized and as follows:

1. Shall be set in the earth a depth of 24-inch with soil firmly compacted around post, unless required otherwise in writing by OAR.

2. Fence fabric shall be attached to posts with #14 gauge tie wire at 16 inches on center. A #6 gauge steel tension wire with turnbuckles shall be installed at top and bottom of barricade fencing. Wire tie fabric to tension wires at 18" centers.

3. Windscreen shall be attached to fence fabric and steel tension wires at 18-inch centers with a minimum of #14 gauge tie wire. Windscreen shall be maintained and all rips, tears, missing sections shall be corrected upon notification by OAR.

4. Chain link fencing shall be free from barbs, icicles or other projections resulting from galvanizing process. Fence having such defects will be replaced even if it has been installed.

5. Gates shall be fabricated of steel pipe with welded corners and bracing as required. Fence and fabric to be attached to frame at 12-inch centers. Provide all gate hardware of a strength and quality to perform satisfactorily until barricade is removed upon Substantial Completion of the Work. Each gate shall have a chain and padlock. Provide two gate keys to OAR. At Substantial Completion of the Work, remove barricade from Project site, backfill and compact fence footing holes. Existing surface paving that is cut into or removed shall be patched and sealed to match surrounding areas.

6. At CONTRACTOR'S expense and without limitation remove or relocate fencing, fabric and barricades or other security and protection facilities as rapidly as required in order to provide for progress of the Work.

1.12 OTHER TEMPORARY ENCLOSURES AND BARRICADES

A. Provide lockable, temporary weather-tight enclosures at openings in exterior walls to create acceptable working conditions, to allow for temporary heating and for security.

B. Provide protective barriers around trees, plants and other improvements designated to remain.

C. Temporary partitions shall be installed at all openings where additions connect to existing buildings, and where to protect areas, spaces, property, personnel, students and faculty and to separate and control dust, debris, noise, access, sight, fire areas, safety and security. Temporary partitions shall be as designated on the Drawings or as specified by ARCHITECT. At CONTRACTOR'S expense and without limitation remove and/or relocate enclosures, barriers and temporary partitions as rapidly as required in order to provide for progress of the Work.

D. Since the Work of this Project may be immediately adjacent to existing occupied structures and vehicular and pedestrian right of ways, CONTRACTOR shall, in his sole judgment and in accordance with applicable safety standards, provide temporary facilities, additional barricades, protection and care to protect existing structures, occupants, property, pedestrians and vehicular traffic. CONTRACTOR is responsible for any damage, which may occur to the property and occupants of the property of OWNER or adjacent private or public properties which in any way results from the acts or neglect of CONTRACTOR.

E. CONTRACTOR shall be responsible for cleaning up all areas adjacent to the construction site which have been affected by the construction; and for restoring them to at least their original condition- including landscaping; planting of trees, sod, and shrubs damaged by construction; and raking and disposal of debris such as roofing shingles, paper, nails, glass sheet metal, bricks, and waste concrete. Construction debris shall be removed and properly disposed of. Culverts and drainage ditches with sediment from the construction area shall be cleared routinely to maintain proper drainage and re-cleaned prior to completion of the contract.

F. CONTRACTOR shall ensure sediment does not block storm drains. CONTRACTOR shall be responsible for cleaning storm drains blocked due to erosion or sediment from the work area.

1.13 TEMPORARY STORAGE YARDS

A. CONTRACTOR shall fence and maintain storage yards in an orderly manner.

B. Provide storage units for materials that cannot be stored outside.

C. At CONTRACTOR'S expense and without limitation remove and/or relocate storage yards and units as rapidly as required in order to provide for progress of the Work.

1.14 TEMPORARY DE-WATERING FACILITIES AND DRAINAGE

A. For temporary drainage and de-watering facilities and operations not directly associated with construction activities included under individual sections, comply with de-watering requirements of applicable Division 01 sections. CONTRACTOR shall maintain the Work, Project site and related areas free of water.

B. For temporary drainage and de-watering facilities and operations directly associated with new buildings, additions or other construction activities, comply with Divisions 01 and 33 Sections. CONTRACTOR shall be responsible for, but not limited to, de-watering of excavations, trenches and below grade areas of buildings, structures, the Project site and related areas.

1.15 TEMPORARY PROTECTION FACILITIES INSTALLATION

A. CONTRACTOR shall not change over from using temporary facilities and controls to permanent facilities until Substantial Completion, except as permitted by OAR.

B. Until permanent fire protection needs are supplied and approved by authorities having jurisdiction, CONTRACTOR shall provide, install and maintain temporary fire protection facilities of the types needed in order to adequately protect against fire loss. CONTRACTOR shall adequately supervise welding operations, combustion type temporary heating and similar sources of fire ignition.

C. CONTRACTOR shall provide, install and maintain substantial temporary enclosures of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security. Where materials, tools and equipment are stored within the Work area, CONTRACTOR shall provide secure lock up to protect against vandalism, theft and similar violations of security. OWNER accepts no financial responsibility for loss, damage, vandalism or theft.

D. CONTRACTOR operations shall not block, hinder, impede or otherwise inhibit the use of required exits and/or emergency exits to the public way, except as approved by OAR. CONTACTOR shall maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for firefighting equipment and/or personnel.

E. With approval of OAR and at the earliest feasible date in each area of the Work, complete installation of the permanent fire protection facilities including connected services and place into operation and use. Instruct OWNER personnel in use of permanent fire protection facilities.

F. In the event of an emergency drill or an actual emergency, designated by the sounding of the fire alarm and/or other sounding device, all construction activities must cease. CONTRACTOR shall evacuate the Work area and remain outside the Work area until permitted to return. No Work shall be conducted during the evacuation of a building or during an emergency.

1.16 TEMPORARY SECURITY AND SAFETY MEASURES

A. During performance of the Work in existing facilities and/or on a Project Site occupied by students, CONTRACTOR shall provide, install and maintain substantial temporary barriers and/or partitions separating all Work areas from areas occupied by students, faculty and/or administrative staff.

B. During performance of the Work in existing facilities or on a Project site occupied by students and where temporary barriers or partitions are not physically feasible, CONTRACTOR shall provide an employee meeting the requirements of Education Code

Section 45125.2.(2) to continually supervise and monitor all employees of CONTRACTOR and Subcontractor. For the purposes of this Section, CONTRACTOR employee shall be someone whom the Department of Justice has ascertained has not been convicted of a violent or serious felony as listed in Penal Code Section 667.5(c) and/or Penal Code Section 1192.7(c). To comply with this Section, CONTRACTOR shall have his employee submit his or her fingerprints to the Department of Justice pursuant to Education Code Section 45125.1(a).

C. Penal Code Sections 290 and 290.4 commonly known as “Megan’s Law”, require, among other things, individuals convicted of sexually oriented crimes, to register with the chief of police where the convicted individual resides or with a county sheriff or other law enforcement officials. CONTRACTOR shall check its own employees and require each Subcontractor to check its employees and report to CONTRACTOR if any such employees are registered sex offenders. CONTRACTOR shall check monthly during the life of the Contract to ascertain this information and report same to OAR. Before starting the Work, and monthly thereafter during the life of Contract, CONTRACTOR shall notify OWNER in writing if any of its employees and/or if any Subcontractor’s employees is a registered sex offender. If so, CONTRACTOR shall proceed in accordance with paragraph B above.

D. CONTRACTOR shall employ and maintain sufficient security and safety measures to effectively prevent vandalism, vagrancy, theft, arson, and all other such negative impacts to the Work. Any impacts to the progress of the Work of CONTRACTOR, OWNER, or OWNER’S forces, due to loss from inadequate security, will be the responsibility of CONTRACTOR.

E. Until Substantial Completion of the Work, CONTRACTOR shall employ appropriate means to remove all graffiti from buildings, equipment, fences and all other temporary and/or permanent improvements on the Project site within twenty-four (24) hours from the date of report or forty-eight (48) hours of each occurrence.

1.17 TEMPORARY ACCESS ROADS AND STAGING AREAS

A. Due to the limited amount of on and off Project site space for the parking of staff and school visitor’s vehicles there will be no parking of CONTRACTOR vehicles in areas designated for school use only. CONTRACTOR shall provide legal access to and maintain CONTRACTOR designated areas for the legal parking, loading, off-loading and delivery of all vehicles associated with the Work. CONTRACTOR shall be solely responsible for providing and maintaining these requirements whether on or off the Project site. CONTRACTOR shall provide and maintain ample on-site parking spaces designated for the exclusive use of OWNER. CONTRACTOR shall erect signs as required by OWNER each of these spaces and prevent all unauthorized vehicles from parking in the OWNER-reserved spaces.

B. Temporary access roads are to be installed and maintained by CONTRACTOR to all areas of the Project site.

C. CONTRACTOR will be permitted to utilize existing facility campus roads as designated by OAR. CONTRACTOR shall only utilize those entrances and exits as designated by OAR and CONTRACTOR shall observe all traffic regulations of OWNER.

D. CONTRACTOR shall maintain roads and walkways in a clean condition including removal of debris and/or other deleterious material on a daily basis.

1.18 DIRECTIONAL SIGNAGE AND ADVERTISEMENT POSTING

A. CONTRACTOR shall provide and install signage to provide directional, identification, and contact information to construction personnel and visitors as follows and as reviewed by OAR.

1. For construction traffic control/flow at entrances/exits, and as designated by OAR.

2. To direct visitors.

3. For construction parking.

4. To direct deliveries.

5. For Warning Signs as required.

6. In accordance with CAL/OSHA standards as necessary.

7. For trailer identification and Project site address.

8. For “No Smoking” safe work site at designated locations.

9. Emergency contact information and phone number of CONTRACTOR.

10. Emergency contact information and phone number of local police, fire, and emergency personnel.

11. For Labor Compliance Program (LCP) as required under the General Conditions (Prevailing wage rates and Notice of LCP)

12. Employee benefits payments paid to trust funds are required under the General Conditions.

B. OWNER has established a program authorizing vendors to post advertisements and billboards along the perimeter of project site. CONTRACTOR shall provide access and shall allow advertising signage to be placed on top of temporary, perimeter, security barricade and/or fences.

1.19 TRENCHES

A. Open trenches for installation of utility lines (water, gas, electrical and similar utilities) and open pits outside barricaded working areas shall be barricaded at all times in a legal manner determined by CONTRACTOR. Trenches shall be backfilled and patch-paved within twenty-four (24) hours after approval of installation by authorities having jurisdiction or shall have "trench plates" installed. Required access to buildings shall be provided and maintained. CONTRACTOR shall comply with all applicable statutes, codes and regulations regarding trenching and trenching operations. Open trenches deeper than 3'-

6", and not located within a public street access, shall be enclosed within an 8'-0" high chain-link fence.

1.20 DUST CONTROL

A. CONTRACTOR is responsible for dust control on and off the Project site. When Work operations produce dust the Project site and/or streets shall be sprinkled with water to minimize the generation of dust. CONTRACTOR shall clean all soils and debris from construction vehicles and cover both earth and debris loads prior to leaving the Project site. CONTRACTOR shall, on a daily basis, clean all streets and/or public improvements within the right of way of any and all debris, dirt, mud and/or other materials attributable to operations of CONTRACTOR.

1.21 WASH OUT

A. CONTRACTOR shall provide and maintain a minimum of four (4) wash out boxes of sufficient size and strength to provide for concrete mixer wash out. CONTRACTOR shall locate and relocate both the wash out boxes and wash out areas in order to accommodate the progression of the Work. The wash out area shall be located as to minimize the amount of potential run off onto adjacent private and/or public property. CONTRACTOR shall legally dispose of the contents of the wash out boxes and area on an as needed basis or as required by OAR.

1.22 WASTE DISPOSAL

A. CONTRACTOR shall provide and maintain trash bins on the Project site. Trash bins shall be serviced on an as needed basis and CONTRACTOR is responsible for the transportation of and the legal disposal of all contents.

1.23 ADVERSE WEATHER CONDITIONS

A. Should warnings of adverse weather conditions such as heavy rain and/or high winds be forecasted, CONTRACTOR shall provide every practical precaution to prevent damage to the Work, Project site and adjacent property. CONTRACTOR precautions shall include, but not be limited to, enclosing all openings, removing and/or securing loose materials, tools, equipment and scaffolding.

B. CONTRACTOR shall provide and maintain drainage away from buildings and structures.

C. CONTRACTOR shall implement all required storm water mitigation measures as required under related Division 01 Sections.

1.24 DAILY AND MONTHLY REPORTS

A. CONTRACTOR shall provide and maintain in the Project site office of CONTRACTOR, a daily sign in sheet for use by all employees of CONTRACTOR and all Subcontractors at whatever tier. At the beginning of each workday, the foreman, project manager, superintendent of CONTRACTOR and/or Subcontractors shall visit the site office of CONTRACTOR and shall enter onto the daily sign in sheet: all employee names; trade classification; and represented company. The completed sign in sheet shall serve as the

basis of and shall be submitted with the daily construction report as set forth in Paragraph B below.

B. By the end of each workday, CONTRACTOR shall submit to OAR and INSPECTOR a daily construction report denoting the daily manpower counts and a brief description/location of the workday activities. Manpower shall be broken down by trade classification such as foreman, journeyman or apprentice. The report shall also note the date, day of the week, weather conditions, deliveries, equipment on the Project site whether active and/or idle, visitors, inspections, accidents and unusual events, meetings, stoppages, losses, delays, shortages, strikes, orders and requests of governing agencies, Construction Directive and/or Change Orders received and implemented, services disconnected and/or connected, equipment start up or tests and partial use and/or occupancies. CONTRACTOR shall also include on the daily construction report the above information for all Subcontractors at whatever tier.

C. CONTRACTOR shall submit on a monthly basis the forms found in Sections 01 3229 and 01 7416 certifying CEQA Mitigations and Storm Water Pollution Prevention (SWPP) compliances.

1.25 FIELD OFFICE SUPPLIES

A. CONTRACTOR shall provide the initial supply of field office supplies to OAR in the quantities listed as set forth below in Table A. If specified in Section 01 2100 – Allowances, CONTRACTOR shall provide additional supplies as required by OAR. CONTRACTOR shall not deduct the costs of the Initial Field Office Supplies (as shown in Table A) from the Allowance for the monthly replenishment of OWNER field office supplies listed in Section 01 2100 – Allowances. CONTRACTOR shall deliver all of the initial field office supplies to OWNER Field Offices within fourteen days from the date established in the Notice to Proceed.

B. CONTRACTOR may utilize different suppliers as the specified information is only to establish the required quantities and minimum levels of quality.

C. Replenishment of Field Office Supplies: If an Allowance is identified in Section 01 2100 – Allowances for the periodic replenishment of OWNER field office supplies. OWNER shall submit requests for replenishment of field office supplies to CONTRACTOR from those listed in Table ‘A’ below. CONTRACTOR shall provide a monthly accounting of items being requested, cumulative cost of replenishment of Field Office supplies previously ordered, and balance of allowance remaining. Upon Substantial Completion of the Work, CONTRACTOR shall file a Change Order Proposal crediting OWNER for any remaining balance or unspent portion of the Allowance. This Allowance specifically excludes the initial supplies listed in Table ‘A’ below and is to be used exclusively for the monthly replenishment of OWNER field office supplies. Supplies are to be delivered to OWNER’S trailer within twenty-four hours of OWNER’S request.

D. Postage and Delivery Costs: CONTRACTOR shall provide postage and delivery services for OWNER generated materials in quantities and/or frequencies as requested by OWNER. The cost for these services shall be deducted from the Allowance identified in Section 01 2100 – Allowances for the periodic replenishment of OWNER field office supplies. This allowance is for the OWNER’S use only. Postage and delivery costs for CONTRACTOR generated materials are the responsibility of the CONTRACTOR and shall not be charged to this allowance, regardless of whether the postage and/or delivery

of CONTRACTOR generated materials resulted from a request and/or direction from OWNER.

E. Other expendable field office support items specified elsewhere, including, but not limited to, furnishing toner cartridges, equipment maintenance, and bottled water, are to be supplied and paid for by CONTRACTOR. These costs are not to be deducted from the Allowance for the periodic replenishment of OWNER field office supplies identified in Section 01 2100.

Table A

ITEM	DESCRIPTION	UNIT	QUANTITY	SUPPLIER/ITEM NUMBER
Three Ring Binders – 3-inch	N/A	Each	**{ SPECIFY }**	Staples / 823526-54
Three Ring Binders – 2-inch	N/A	Each	**{ SPECIFY }**	Staples / 816199-54
Three Hole Punch	N/A	Each	**{ SPECIFY }**	Staples / 893844
Two Hole Punch	N/A	Each	**{ SPECIFY }**	Staples / 506261-54
File Organizer	N/A	Each	**{ SPECIFY }**	Staples / 120162-54
Calculator	Canon WS-1400H	Each	**{ SPECIFY }**	Staples / 342763
Flash Drive	2 GB	2	**{ SPECIFY }**	
Wastebasket	N/A	Each	**{ SPECIFY }**	Staples / 125039-54
Digital Camera	5 megapixel	Each	1	
Camera Flash Memory with reader for computer	5 GB	Each	1	
Camera Batteries and Rechargeable Batteries with charger	Appropriate to Camera	Each	1	
Cordless Phone with Answering Machine	AT&T Dect 6.0	Each	1	Staples / 1148831
Surge Suppressors	N/A	Each	**{ SPECIFY }**	Staples / IM1RA1696
Flashlight	N/A	Each	**{ SPECIFY }**	Staples / 222397
Batteries	N/A	4/Lot	**{ SPECIFY }**	Staples / 318956-54
Clipboard	N/A	3/Lot	**{ SPECIFY }**	Staples / 450422-54
8-inch Cast Iron Shears	N/A	Each	**{ SPECIFY }**	Staples / 421040-54
First Aid Kit	N/A	Each	1	Staples / 503979-54
Journal	N/A	Each	**{ SPECIFY }**	Staples / 217695-54
Pens (blue, green and red)	N/A	12/Lot	**{ SPECIFY }**	Staples / 441884-64
Pencils	N/A	48/Lot	**{ SPECIFY }**	Staples / 711382-54
Pencil Sharpener	1900	1	**{ SPECIFY }**	Staples / 330250-54
Mouse Pad	N/A	Each	**{ SPECIFY }**	Staples / 382955-64
Date Received Stamp	N/A	Each	1	Staples / 920274-54
Colored Pencils	N/A	12/Lot	**{ SPECIFY }**	Staples / 317297-54
Markers	N/A	12/Lot	**{ SPECIFY }**	Staples / 932675
Telephone Message Book	N/A	Each	**{ SPECIFY }**	Staples / 194506
Wall Calendar	PM233-28	Each	**{ SPECIFY }**	Staples / 527861-54
Steno Pad	N/A	12/Lot	**{ SPECIFY }**	Staples / 163485-64
Legal Pad	N/A	12/Lot	**{ SPECIFY }**	Staples / 163865-64
Post Its	N/A	12/Lot	**{ SPECIFY }**	Staples / 130005-64
File Folders – 8-1/2 by 11	N/A	50/Lot	**{ SPECIFY }**	Staples / 831099-54
File Folders – 8-1/2 by 14	N/A	50/Lot	**{ SPECIFY }**	Staples / 831057-54
Tape / Dispenser	N/A	Each	**{ SPECIFY }**	Staples / 211540-54
Highlighters	N/A	12/Lot	**{ SPECIFY }**	Staples / 167031

Rubber Bands	N/A	Each	**{ SPECIFY }**	Staples / 808634
Push Pins	N/A	Each	**{ SPECIFY }**	Staples / 480118-54
Dry Erase Board	S537	Each	**{ SPECIFY }**	Staples / 518928-54
Binder Clip – Medium	N/A	24/Lot	**{ SPECIFY }**	Staples / 831602-54
Binder Clip - Large	N/A	12/Lot	**{ SPECIFY }**	Staples / 831610-54
Stapler	818	Each	**{ SPECIFY }**	Staples / 504308
3 Pocket Wall File	N/A	Each	**{ SPECIFY }**	Staples / 730523-54
Heavy Duty Stapler	415	Each	1	Staples / 386312-54
Heavy Duty Staples	SW1-35312	Each	1	Staples / 504191-54
Hanging File Folder	8-1/2 x 11	25/Lot	**{ SPECIFY }**	Staples / 116806-54
Hanging File Folder	8-1/2x14	25/Lot	**{ SPECIFY }**	Staples / 163352-54
File Folder Labels	5266	750/Lot	**{ SPECIFY }**	Staples / 287292-54
Fax Notes	N/A	12/Lot	**{ SPECIFY }**	Staples / 210625-64
Paper Clips	N/A	Each	**{ SPECIFY }**	Staples / 480108-54
Paper Clips	N/A	Each	**{ SPECIFY }**	Staples / 480109-54
Poster Kit - State	CA	Each	1	Staples / 1183148
Poster Kit - Federal	US	Each	1	Staples / 935983-54
Broom	N/A	Each	1	Staples / 256600
Fire Extinguisher	First Alert	Each	**{ SPECIFY }**	Staples / 238774-54
Copy Paper	8-1/2 x 11	5000/Case	**{ SPECIFY }**	Staples / 122374-69
Copy Paper	8-1/2 x 14	500/Ream	**{ SPECIFY }**	Staples / 122598-69
Copy Paper	11 x 17	500/Ream	**{ SPECIFY }**	Staples / 238105-69
Hardhats	White	Each	**{ SPECIFY }**	Fiber Metal Model E-2 Ratchet knob full range size adjustment
Safety Glasses	Clear and/or Tinted	Each	**{ SPECIFY }**	Crews Storm Series
Safety Vests, Zipper Front	Hi Vis Lime Yellow	Each	**{ SPECIFY }**	Aramak Wearguard Item DEF-1085

PART 2 – PRODUCTS – Not Used

PART 3 – EXUTION – Not Used

END OF SECTION

APPENDIX A

END OF APPENDIX A

SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

A. Section 01 3229 - Project Forms.

B. Section 01 3113 - Project Coordination.

C. Section 01 3300 - Submittal Procedures.

D. Section 01 3216 - Construction Schedule.

E. Section 01 4523 - Testing and Inspection.

F. Section 01 2513 - Product Substitution Procedures.

G. Section 01 7836 - Warranties.

1.03 DEFINITIONS

A. Definitions used in this Section are not intended to change the meaning of other terms used in the Contract Documents, such as “specialties,” “systems,” “structure,” “finishes,” “accessories,” and other similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry.

1. “Products” are items purchased for incorporation into the Work, whether purchased for the Work or taken from previously purchased stock. The term “product” includes the terms “material” and “equipment” and terms of similar intent.

a. “Named Products,” are items identified by the manufacturer’s product name, including make, model number or other designation, shown or listed in the manufacturer’s published product literature, current as of the date of the Contract.

b. “Foreign Products,” as distinguished from “domestic products,” are items substantially manufactured (50 percent or more of value) outside the United States and its possessions. Products produced or supplied by entities substantially owned (more than 50 percent) by persons who are not citizens of, nor living within, the United States and its possessions are also considered to be foreign products.

2. “Materials,” are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.

3. “Equipment,” is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.04 SUBMITTALS

A. Material list: Prepare a list in tabular form acceptable to ARCHITECT and/or OAR showing proposed products. Include generic names. Include the manufacturer’s name and proprietary names for each item listed.

1. Coordinate material list with the Construction Schedule and the submittal schedule.

2. Form: Prepare material list with information on each item tabulated under the following column headings.

a. Related Specification Section number.

b. Generic name used in Contract Documents.

c. Proprietary name, model number, and similar designations.

d. Manufacturer’s name and address.

e. Supplier’s name and address.

f. Installer’s name and address.

g. Projected delivery date or time span of delivery period.

3. Initial Submittal: Within ten days after execution of each subcontract agreement, as set forth in General Conditions Article 6.23, submit three copies of an initial material list to the ARCHITECT with a copy to the OAR. Provide a written explanation for omissions of data and for known variations from the Contract Documents.

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

1.05 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.

1. CONTRACTOR is to verify necessary lead times for all materials; however, when specified products are available only from sources that do not, or cannot, produce a quality adequate to complete Work in a timely manner, consult with the ARCHITECT to determine the most important product qualities before proceeding. Qualities may include attributes, such as visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources producing these qualities, to the fullest extent possible.

B. Compatibility of Options: When the CONTRACTOR is given the option of selecting between two or more products for use in the Work, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

C. Foreign Product Limitations: Except under one or more of the following conditions, provide domestic products, not foreign products, for inclusion into the Work:

1. No available domestic product complies with the Contract Documents.

2. Domestic products that comply with the Contract Documents are available only at prices or terms substantially higher than foreign products that comply with the Contract Documents.

D. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturers or producer's nameplates or trademarks on exposed surfaces of products that will be exposed in view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.

2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:

a. Name of product and manufacturer.

b. Model and serial number.

c. Capacity.

d. Speed.

e. Ratings.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products according to the manufacturer’s recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.

1. Schedule delivery to minimize long-term storage at the Project site and to prevent overcrowding of Work spaces.

2. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

3. Deliver products to the Project site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

4. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

5. Store products at the Project site in a manner that will facilitate inspection and measurement of quantity or counting of units.

6. Store heavy materials away from structures in a manner that will not endanger the structure's supporting construction.

7. Store products subject to damage by the elements above ground, under cover in a weather-tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS

2.01 MATERIAL SELECTION

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.

1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.

2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other Projects.

B. Product Selection Procedures: The Contract Documents and governing regulations govern product selection. Procedures governing product selection include the following:

1. Proprietary Specification Requirements: Where Specifications name only a single material or manufacturer, provide the product indicated. No substitutions will be permitted.

2. Semi-proprietary Specification Requirements: Where Specifications name two or more products or manufacturers, provide one of the products indicated. No substitutions will be permitted.

    a. Where Specifications specify products or manufacturers by name, accompanied by the term “or equal” comply with General Conditions Article 6.14 to obtain approval for use of an unnamed product.

3. Descriptive Specification Requirements: Where Specifications describe a product or assembly, list exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with the Contract Documents.

4. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by the manufacturer for the application indicated.

    a. Manufacturer’s recommendations may be contained in published material literature or by the manufacturer’s certification of performance.

5. Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes, or regulations specified.

6. Visual Matching: Where Specifications require matching an established Sample, decision of the ARCHITECT will be final on whether a proposed product matches satisfactorily.

7. Visual Selection: Where specified product requirements include the phrase “… as selected from manufacturer’s standard or premium colors, patterns, textures…” or a similar phrase, select a product and manufacturer that complies with other specified requirements. The ARCHITECT will select the color, pattern, and texture from the product line selected.

PART 3 - EXECUTION

3.01 INSTALLATION OF PRODUCTS

A. Comply with manufacturer’s instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located, and aligned with other Work.

B. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration until Substantial Completion.

END OF SECTION

SECTION 01 7123

FIELD ENGINEERING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Layout of the work

2. Verification of work

a. OWNER reserves the right to verify any work that INSPECTOR deems necessary.

b. Other sections that require Surveyor to verify or measure installed work and related item. Surveyor shall perform such verifications or measurements at CONTRACTOR'S expense. CONTRACTOR shall furnish a certification, signed by both Surveyor and CONTRACTOR, to INSPECTOR.

B. Related Requirements:

1. Section 01 1100 - Summary of Work.

2. Section 01 3113 - Project Coordination.

3. Section 01 3216 - Construction Schedule.

4. Section 01 3300 - Submittal Procedures.

5. Section 01 7700 - Contract Closeout.

1.02 SURVEY CONTROLS

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

B. Horizontal control for existing structures shall be the property line.

1.03 LAYOUT OF WORK

A. All work related to staking shall be by a Land Surveyor, or Civil engineer, registered with the State of California to perform land surveying and employed by CONTRACTOR.

B. Before commencement of Work, surveyor shall locate all reference points and benchmarks to be used for vertical and horizontal control.

C. Surveyor shall lay out entire Work, set grades, lines, levels, control points, elevations, grids and positions.

1.04 RECORD DOCUMENTS

A. Maintain complete and accurate log of all control and survey documentation as work progresses.

B. Record, by coordinates, all utilities onsite with top of pipe elevations, at major grade and alignment changes, rim, grate or top of curb and flow line elevations of all drainage structures and sewer manholes.

C. Indicate reference and control points on record drawings. The basis of elevation shall be one of the established benchmarks.

D. Upon Substantial Completion, obtain and pay for reproducible plans. Deliver plans to OAR. Clearly indicate all differences between original drawings and completed work within specified tolerances.

1.05 SUBMITTALS

A. Surveyor: Shall submit name, address and license number to OWNER, including any changes as they occur.

B. Field notes: Upon request by OAR, submit copies of cut sheets, coordinate plots, data collector printouts, marked-up construction staking plans and other documentation as available to verify accuracy of field engineering work during and at completion of project. Submittals to OWNER must be signed and sealed by Surveyor and counter-signed by CONTRACTOR

C. Statement of Compliance: CONTRACTOR shall submit a statement of certification signed and sealed by Surveyor, counter-signed by CONTRACTOR indicating compliance with grades and alignment of construction plans at rough grade, fine grade and top of rock stages. INSPECTOR shall approve survey submittals for each stage of construction prior to proceeding with work

D. Upon Substantial Completion, CONTRACTOR shall obtain and pay for reproducible survey drawings (or “As Built”).

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

PART 2-PRODUCTS – NOT USED

PART 3-EXECUTION

3.01 PREPARATION

A. Pre-mark areas of excavation in accordance with the requirements of “Dig-Alert”. Request locators 2 days before commencing excavation.

B. Before commencing Work, establish all horizontal and vertical reference points used in Contract Documents according to existing field conditions.

C. Preserve established reference lines and benchmarks.

D. Differentiate school and city datum as applicable.

E. Relocate bench marks that may interfere with Work.

F. Reset and re-establish reference marks damaged or lost during construction.

3.02 SURVEY REQUIREMENTS GENERAL

A. Establish a minimum of two permanent horizontal and vertical control points on Project site, remote from construction area, referenced to data established by control points.

B. Indicate reference points, relative to benchmark elevation, on record drawings.

C. Provide grade stakes and elevations to construct over excavation and re-compaction, rough and final grades, paved areas, curbs, gutters, sidewalks, building pads, landscaped areas, and other areas as required.

D. Calculate and layout proposed finished elevations and intermediate controls as required to provide smooth transitions between spot elevations indicated on Drawings.

E. Provide stakes and elevations for grading, fill, and topsoil placement.

F. Provide adequate horizontal and vertical control to locate utility lines, including but not limited to, storm, sewers, water mains, gas, electric and signal and provide vertical control in proportion to the slope of the line as required for accurate construction. Dry utilities will be based upon adequate horizontal and vertical control layout. Prior to trench closure, survey and record invert and flow line elevations. Survey and record top of curb and flow line elevations on finished concrete or asphaltic concrete (AC) surfaces at key locations such as beginning-of-curve (BC), end-of-curve (EC), grade breaks, corners or angle points in sufficient number to demonstrate the Work complies with the intent of the Contract Documents.

G. Provide horizontal and vertical control for batter boards for drainage, utility, and other on-site structures as required.

H. Furnish building corner offsets as required to adequately locate building pads. Provide cut and fill stakes within the building pad perimeter adequate to control both over excavation and re-compaction and the final sub-grade elevation of the building pad.

I. Submit a certification signed by the surveyor confirming the elevations and locations of improvements are in conformance with the Contract Documents. The statement shall include survey notes for the finish floor and building pad, showing the actual measured elevations on the completed sub-grade, recorded to the nearest 0.01 of a foot. Building pad tolerance will be plus or minus 0.1 of a foot.

J. Establish a minimum of two permanent horizontal and vertical control points on Project site, remote from building area, referenced to data established by survey control points.

K. Mark boundaries for rights-of-way dedications and easements for utilities prior to making location of buildings and utilities.

L. Layout all lines, elevations and measurements needed for construction or installation of buildings, grading, paving utilities according to the following:

1. Identify site boundary, property lines.

2. Provide working benchmarks.

3. Set stakes for Bottom of Excavated Plane (B.E.P.).

4. Set gridlines, radii, working points etcetera, for foundation.

5. Set and verify building pad elevations.

6. Set finish floor elevations.

7. Stake location and elevations for exterior ramps and stairs.

8. Set gridlines, radii, working points, etcetera, for all floors of multi-story buildings.

9. Set storm drain and sanitary sewer inverts and other utilities as needed at 5-foot off-set from building lines.

10. For new facilities, establish permanent onsite Benchmark with 2-inch diameter brass disk. Location of Benchmark to be determined by OWNER.

3.03 SURVEY REQUIREMENTS FOR GRADING

A. Provide grade stakes and elevations as follows:

1. Removal limits (cut lines).

2. Rough grade staking: 60-foot maximum grid plus additional stakes at grade changes and pertinent locations. Flag all grade changes including ridges, flow lines and grade breaks.

3. Fine grade for top of dirt: 30-foot maximum grid plus additional stakes at grade changes and pertinent locations. Flag all grade changes including ridges, flow lines and grade breaks.

4. Verify fine grade for top of rock: 30-foot maximum grid plus additional stakes at grade changes and pertinent locations. Flag all grade changes including ridges, flow lines and grade breaks.

5. Finish grade marks on all buildings, structures and at pertinent locations

6. Finish grades and offsets for all concrete work, utilities, landscape areas, and structures.

7. Provide controls and baselines for playground striping.

8. Offsite improvements: set grades and provide grade sheets as required by local authorities.

B. Provide a minimum of two permanent horizontal and vertical control points onsite, remote from building area, referenced to data established by survey control points.

3.04 SURVEY REQUIREMENTS FOR UTILITIES

A. Locate “wet” utility lines and provide vertical control proportionate to slope of line as required for accurate construction. “Dry” utilities shall have adequate horizontal and vertical control layout supplied by others.

B. Prior to back-filling trench, survey and record invert and flow line elevations. Survey and record top of curb and flow line elevations on finished surfaces at key locations (such as Back of Curbs, grade breaks, corners or angle points) in sufficient number to demonstrate Work complies with intent of Contract Documents.

C. Provide horizontal and vertical control for batter boards for drainage, utility, and other on-site structures as required.

1. Set grades for vaults one inch higher than adjacent surrounding design grades, unless noted otherwise.

D. Leave all trenches open until required inspection is completed.

3.05 SURVEY REQUIREMENTS FOR STRUCTURES

A. Furnish building corner offsets as required to adequately locate building pads. Provide cut and fill stakes within building pad perimeter adequate to control both over excavation and re-compaction and final sub-grade elevation of building pad.

B. Submit a certification signed by surveyor confirming elevations and locations of improvements are in conformance with Contract Documents. Statement shall include survey notes for finish floor and building pad, showing actual measured elevations on completed sub-grade, recorded to nearest 0.01 of a foot. Building pad tolerance will be plus or minus 0.1 of a foot.

END OF SECTION

SECTION 01 7329

CUTTING AND PATCHING

PART 1 - GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

A. Section 01 2973 - Schedule of Values.

B. Section 01 3113 - Project Coordination.

C. Section 01 3119 - Project Meetings.

D. Section 01 3213 - Construction Schedule.

E. Section 01 3300 - Submittal Procedures.

F. Section 01 7123 - Field Engineering.

G. Section 01 7836 - Warranties.

H. Section 01 4525 - Testing, Adjusting, and Balancing of HVAC.

1.03 SUBMITTALS

A. The word “cutting” as used in the Contract Documents includes, but is not limited to, cutting, drilling, chopping, and other similar operations and the word “patching” includes, but is not limited to, patching, rebuilding, reinforcing, repairing, refurbishing, restoring, replacing, or other similar operations.

B. Cutting and Patching Proposal: CONTRACTOR shall submit a proposal describing procedures well in advance of the time cutting and patching will be performed if the Contract Documents requires approval of these procedures before proceeding. Include the following information, as applicable, in the proposal:

1. Describe the extent of cutting and patching required. Denote how it will be performed and indicate why it cannot be avoided.

2. Describe anticipated results in terms of changes to existing construction. Include changes to structural elements and operating components as well as changes in the building’s appearance or other significant visual elements.

3. List products to be used and firms or entities that will perform this Work.

4. Indicate dates when cutting and patching will be performed.

5. Utilities: List utilities that cutting and patching operations will disturb or affect. List utilities to be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.

6. Where cutting and patching involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the original structure.

7. Review by ARCHITECT and DSA prior to proceeding with cutting and patching does not waive ARCHITECT right to later require complete removal and replacement of defective Work.

1.04 QUALITY ASSURANCE

A. Requirements for structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.

1. Obtain approval from ARCHITECT and DSA of the cutting and patching proposal before cutting and patching the following structural elements:

a. Foundation construction.

b. Bearing and retaining walls.

c. Structural concrete.

d. Structural steel.

e. Lintels.

f. Timber and primary wood framing.

g. Structural decking.

h. Stair systems.

i. Miscellaneous structural metals.

j. Exterior curtain-wall construction.

k. Equipment supports.

l. Piping, ductwork, vessels, and equipment.

m. Structural systems of special construction in Division 13 Sections.

B. Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not

cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safely.

1. Obtain review of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:

    a. Primary operational systems and equipment.

    b. Air or smoke barriers.

    c. Water, moisture, or vapor barriers.

    d. Membranes and flashings.

    e. Fire protection systems.

    f. Noise and vibration control elements and systems.

    g. Control systems.

    h. Communication and/or data systems.

    i. Conveying systems.

    j. Electrical wiring systems.

    k. Operating systems of special construction in Division 13 Sections.

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the opinion of ARCHITECT, reduce the building's aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

1. If possible, retain the original installer or fabricator to cut and patch the exposed Work listed below. If it is impossible to engage the original installer or fabricator, engage another recognized experienced and specialized firm.

    a. Firestopping.

    b. Acoustical ceilings.

    c. Acoustical panels.

    d. Finished wood flooring.

    e. Synthetic sports flooring.

    f. Carpeting.

    g. HVAC enclosures, cabinets, or covers.

h. Ceramic and quarry tile.

i. Gypsum board.

j. Masonry (exterior and interior where exposed).

k. Tack boards.

l. Casework.

m. Finish carpentry.

1.05 WARRANTY

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

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.01 INSPECTION

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

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

3.02 PREPARATION

A. Temporary support: Provide adequate temporary support of existing improvements or Work to be cut.

B. Protection: Protect existing improvements and Work during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of existing improvements or Work that might be exposed during cutting and patching operations.

C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Where the Work requires sandblasting of existing surfaces in order to receive new materials secured by cementitious, adhesive or chemical bond, completely remove existing finishes, stains, oil, grease, bitumen, mastic and adhesives or other substances deleterious to the new bonding or fastening of new Work. Utilize wet sand blasting for

interior surfaces and for exterior surfaces where necessary to prevent objectionable production of dust.

3.03 PERFORMANCE

A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay. Carefully remove existing Work to be salvaged and/or reinstalled. Protect and store for reuse into the Work. Verify compatibility and suitability of existing substrates before starting the Work.

B. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining Work. Where possible, review proposed procedures with the original installer; comply with the original installer's recommendations.

1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

3. Cut through concrete and masonry using a cutting machine, such as a carborundum saw or a diamond-core drill. Saw cut reinforcing bars and paint ends with bituminous paint except where bonded into new concrete or masonry.

4. Comply with requirements of applicable Sections of Divisions 31, 32, and 33 where cutting and patching requires excavating, backfill, and recompaction.

5. Woodwork: Cut and or remove to a panel or joint line.

6. Sheet Metal: Remove back to joint, lap, or connection. Secure loose or unfastened ends or edges and seal watertight.

7. Glass: Remove cracked, broken, or damaged glass and clean rebates and stops of setting materials.

8. Plaster: Cut back to sound plaster on straight lines, and back bevel edges of remaining plaster. Trim existing lath and prepare for new lath.

9. Gypsum Wallboard: Cut back on straight lines to undamaged surfaces with at least two opposite cut edges centered on supports.

10. Acoustical ceilings: Remove hanger wires and related appurtenances where ceilings are not scheduled to be installed.

11. Tile: Cut back to sound tile and backing on joint lines.

12. Flooring: Completely remove flooring and clean backing of prior adhesive. Carefully remove wood flooring for patching and repairing of existing wood flooring scheduled to remain.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with required tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation. Verify conditions of existing substrates prior to executing Work.

2. Restore exposed finishes of patched areas and extend finish restoration into retaining adjoining construction in a manner that will eliminate all evidence of patching and refinishing.

3. Concrete: Maintain cut edges in a moist condition for twenty four hours prior to the placement of new concrete. In lieu of this an epoxy adhesive may be provided. Finish placed concrete to match existing unless noted otherwise. Concrete shall have a compressive strength of 3,000 psi where installed to repair and match existing improvements, unless noted otherwise.

4. Metal Fabrications: Items to remain exposed shall have their edges cut and ground smooth and rounded.

5. Sheet Metal: Replace removed or damaged sheet metal items for new Work.

6. Glass: Install matching glass and re-seal exterior window assemblies.

7. Lath and Plaster: Install new lath materials to match existing and fasten to supports at 6-inch centers. Provide a 6-inch lap where new lath to adjoins existing lath. Fasten new lath as required for new Work. Restore paper backings as required. Apply a bonding agent on cut edges of existing plaster. Apply three coat plaster of the type, thickness, finish, texture, and color to match existing.

8. Gypsum Wallboard: Fasten cut edges of wallboard. Install patches with at least two opposite edges centered on supports and secure at 6-inch centers. Tape and finish joints and fastener heads. Patching shall be non-apparent when painted or finished.

9. Acoustical Ceilings: Comply with the requirements for new Work specified in related sections of the Contract Documents.

10. Resilient Flooring: Completely remove flooring and prepare substrate for new material.

11. Painting: Prepare areas to be patched, patch and paint as specified under related sections of the Contract Documents.

3.04 CLEANING

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

END OF SECTION

SECTION 01 7700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes administrative and procedural requirements for Contract Closeout, including but not limited to, the following:

1. Inspection procedures.

2. Project record documents submittal.

3. Operation and maintenance manual submittal.

4. OWNER orientation and instruction.

5. Final cleaning.

1.02 RELATED REQUIREMENTS:

1. Section 01 2976 - Progress Payment Procedures.

2. Section 01 3213 - Construction Schedule.

3. Section 01 3229 - Project Forms.

4. Section 01 3300 - Submittal Procedures.

5. Section 01 4525- Testing, Adjusting, and Balancing of HVAC.

6. Section 01 5000 - Construction Facilities and Temporary Controls.

7. Section 01 7836 - Warranties.

PART 2 – PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 SUBSTANTIAL COMPLETION

A. Inspection Procedures: On receipt of the Request For Certificate of Substantial Completion, OAR will authorize commencement of inspection. INSPECTOR, OAR, CONTRACTOR and ARCHITECT will inspect the Work.

1. If after inspection of the Work, OAR does not consider the Work substantially complete, OAR will notify CONTRACTOR.

2. If after inspection, OAR considers the Work substantially complete, INSPECTOR shall prepare a comprehensive Punch List of items to be corrected.

a. INSPECTOR may repeat inspection to assure the Work is corrected.

b. Results of the completed inspection will form a partial basis of the requirements for Release of Retention.

3.02 ADMINISTRATIVE CLOSEOUT

A. Re-inspection Procedures: INSPECTOR, OAR, CONTRACTOR and ARCHITECT may inspect the Work upon notice, including final inspection of Punch List items from earlier inspections, has been corrected, except for items whose completion is delayed under circumstances acceptable to OAR.

1. OWNER has the right to preclude CONTRACTOR from Punch List correction and documents submittals after the Contract Completion date; unless OWNER elects to authorize CONTRACTOR to extend Administrative Contract duration. CONTRACTOR will be assessed actual cost for the unsettled items. Withholds amounts exceeding actual costs to correct or to obtain deliverable will be released.

2. If allowed by the OAR, re-inspection will be repeated, but may be assessed against CONTRACTOR if OWNER is subject to additional professional service and or additional costs of inspection.

3.03 PROJECT RECORD DOCUMENT SUBMITTAL

A. General: Do not use project record documents for construction purposes. Protect record documents from deterioration and loss. Provide access to record documents for ARCHITECT, INSPECTOR and OAR reference during normal working hours. Project record document shall be updated on a weekly basis. Prior to submitting each application for payment, secure INSPECTOR and ARCHITECT approval of project record documents.

B. Record Drawings: Maintain a clean, undamaged set of prints of Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark the Drawing that is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location

on the Drawings. Provide detailed and accurate field dimensions for concealed elements that would be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work. Date and number entries in the same format as submitted. Call attention to entry by a “cloud” around the affected areas.

2. Mark new information important to OWNER but was not shown on Drawings or Shop Drawings.

3. Utility location and depth below finished grade and above ceilings and attic spaces shall be fully dimensioned and indicated on record drawings. Dimensions shall be measured from building lines or permanent landmarks and shall be triangulated to those features.

4. Note related Change Order or Construction Directive numbers where applicable. RFC submissions shall be referenced on each affected sheet, Drawing and Shop Drawing.

5. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.

6. Prior to Contract Completion of the Work, review of the project record drawings by ARCHITECT; prepare a final set of project record drawings using reproducible vellum. Submit final set of transparencies to ARCHITECT.

C. Record Specifications: Maintain two complete copies of the Specifications, including Addenda. Include with the Specifications two copies of other written Contract Documents, such as Change Orders or Construction Directives issued during construction.

1. Mark these record documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.

2. Give particular attention to substitutions and selection of options and information on concealed Work that cannot otherwise be readily discerned later by direct observation.

3. Note related record document information with Product Data.

4. Prior to Contract Completion of the Work, submit record Specifications to ARCHITECT for OWNER records.

D. Record Product Data: Maintain two copies of each Product Data submittal. Note related Change Orders and Construction Directives and mark-up of record drawings and Specifications.

1. Mark these documents to illustrate significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the Project site and from the manufacturer's installation instructions and recommendations.

2. Provide detailed and accurate information regarding concealed products and portions of Work that cannot otherwise be readily discerned later by direct observation.

3. Prior to Contract Completion, submit complete set of record Product Data to ARCHITECT for OWNER records.

E. Record Samples: Immediately prior to Substantial Completion, CONTRACTOR shall meet with ARCHITECT and OAR at the Project site to determine which Samples are to be transmitted to OWNER for record purposes. Comply with OAR instructions regarding delivery to OWNER storage area.

F. Miscellaneous Records: Refer to other Specification sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Prior to the date of Contract Completion, complete and compile miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to Architect for OWNER records.

G. Maintenance Manuals: Prior to Substantial Completion, organize operation and maintenance data into suitable two sets of manageable size. Bind properly indexed data in individual, heavy-duty, two to three-inch 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Submit to ARCHITECT for OWNER records. Include the following types of information.

1. Emergency instructions.

2. Spare parts list.

3. Copies of warranties.

4. Wiring diagrams.

5. Recommended "turn-around" cycles.

6. Inspection procedures.

7. Shop Drawings and Product Data.

8. Fixture lamping schedule.

H. Verified Reports: Construction progress of the Work shall be reported to DSA via a duly verified report as per Title 24, Part 1, Sections 4-336 and 4-343.c of the California Building Standards Commission's, California Administrative Code.

3.04 OPERATION AND MAINTENANCE:

A. Operation and Maintenance Instructions: Prior to Substantial Completion, arrange for each installer of equipment that requires regular operation and maintenance to meet with designated OWNER personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:

1. Maintenance manuals.

2. Spare parts and materials.

3. Tools.

4. Lubricants.

5. Fuels.

6. Identification systems.

7. Control sequences.

8. Hazards.

9. Cleaning.

10. Warranties and bonds.

11. Maintenance agreements and similar continuing commitments.

B. As part of instruction for operating equipment, demonstrate the following procedures:

1. Start-up.

2. Shutdown.

3. Emergency operations.

4. Noise and vibration adjustments.

5. Safety procedures.

6. Economy and efficiency adjustments.

7. Effective energy utilization.

C. Notice Of Termination: CONTRACTOR shall submit a Notice of Termination (NOT) to the local Regional Water Quality Control Board, RWQCB. Provide a copy of NOT to OAR.

3.05 FINAL CLEANING

A. General: Related sections of the Contract Documents specify general cleaning during performance of the Work. General cleaning is included in Division 01 Section “Construction Facilities and Temporary Controls”.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer’s instructions.

1. Complete the following cleaning operations before requesting inspection for a certificate of Substantial Completion.

a. Remove labels that are not permanent labels.

b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

c. Clean exposed exterior and interior hard-surfaced finished to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

e. Clean the Project site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.

END OF SECTION

SECTION 01 7836

WARRANTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes administrative and procedural requirements for warranties, including manufacturers and installer's standard warranties on products and special product warranties.

1. Refer to the General Conditions for terms of the guarantee period for the Work.

1.02 RELATED REQUIREMENTS

A. Section 01 6000 - Product Requirements.

B. Section 01 7329 - Cutting and Patching.

C. Section 01 7700 - Contract Closeout.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.01 WARRANTY REQUIREMENTS

A. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties shall not relieve CONTACTOR of the warranty of the Work incorporating such materials, products, and equipment. Manufacturer's disclaimers and limitations on warranties do not relieve suppliers, manufacturers, installers, and Subcontractors of the requirement to countersign special warranties with CONTRACTOR.

B. Standard warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to OWNER.

C. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for OWNER.

D. Related Damages and Losses: When correcting failed or defective warranted Work, remove and replace Work that has been damaged as a result of such failure or which must be removed and replaced to provide access for correction of warranted Work.

E. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement with the reinstated warranty equal to the original warranty.

F. Replacement Cost: Upon determination the Work covered by a warranty has failed and/or is defective, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. CONTRACTOR is responsible for the cost of replacing or rebuilding defective Work regardless of whether OWNER has benefited from use of the Work through a portion of its anticipated useful service life.

G. OWNER Recourse: Expressed warranties made to OWNER are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which OWNER can enforce such other duties, obligations, rights, or remedies.

H. Rejection of Warranties: OAR reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

I. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, OAR reserves the right to refuse to accept the Work until CONTRACTOR presents evidence the entities required to countersign such commitments have done so.

3.02 SUBMITTALS

A. Submit written preliminary warranties prior to Substantial Completion and final warranties prior to Contract Completion. If the certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, submit written warranties as set forth in the certificate of Substantial Completion.

1. When a designated portion of the Work is partially used and/or occupied by OWNER, submit properly executed warranties to ARCHITECT within fifteen days of the Partial Use or Occupancy of the designated portion of the Work.

B. When the Contract Documents require CONTRACTOR, or CONTRACTOR and a Subcontractor, installer, supplier or manufacturer to execute a special warranty, prepare a written document containing appropriate terms and identification, ready for execution by the required parties. Submit a draft to OAR, through the ARCHITECT, for approval prior to final execution.

1. Refer to Divisions 02 through 49 for specific content requirements and particular requirements for submitting special warranties.

C. Form of Submittal: Prior to Contract Completion, compile two copies of each required final warranty properly executed by CONTRACTOR, or by CONTRACTOR and Subcontractor, installer, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the Specifications.

D. Bind warranties and bonds in heavy-duty, commercial-quality, durable three ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8½ by 11 paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the item or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the installer.

2. Identify each binder on the front and spine with the typed or printed title “WARRANTIES,” Project title and/or name, and name of CONTRACTOR.

3. When warranted Work requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

END OF SECTION

SECTION 01 7900

MAINTENANCE AND OPERATIONS STAFF DEMONSTRATION AND TRAINING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Administrative and procedural requirements for training OWNER's personnel.

1. Demonstration of operations of systems, subsystems and equipment.

2. Training in operation and maintenance of systems, subsystems, and equipment.

1.02 RELATED REQUIREMENTS

A. Project Commissioning Plan (CxP).

B. CHPS Best Practices Manual.

C. CAL/OSHA Minimum Ventilation Standard, Title 8, Section 5142.

D. California Building Code, Chapter 12.

E. Division 01 - General Requirements.

F. Division 22 - Plumbing.

G. Division 23 – Heating Ventilating and Air Conditioning.

H. Division 26 - Electrical.

I. Division 27 – Communications.

1.03 SUBMITTALS

A. Submittals, including training modules, require the Commissioning Services Provider's (CxSP) review and OAR acceptance prior to implementation.

B. Instruction Program:

1. Ninety days prior to Startup and Testing, submit a draft outline of the instructional program for demonstration and training, including the training module objectives and outline for each training module, schedule of proposed training dates, training times, length of instruction time and instructors' names for each training module. Submittal(s) shall be on a CD-ROM in a MS Word 2013 format file. CxSP, OAR and Project Inspector will review and OAR accept, based on their recommendation,

CONTRACTOR 's proposed Instruction Program or comment and return to CONTRACTOR for revision and incorporation of comments within 30 days of receipt.

2. Revise and resubmit finalized Instruction Program 45 days prior to Startup and Testing. CxSP, OAR and Project Inspector will review CONTRACTOR's revised Instruction Program and OAR, based on their recommendation, accept or return for further revision and incorporation of unaddressed revisions and/or comments or unacceptable revisions within five days of receipt.

3. Revise and incorporate comments and resubmit to OAR within five days of receipt. CxSP, OAR and Project Inspector will review CONTRACTOR's revised Instruction Program and OAR, based on their recommendation, accept the revised Instruction Program within five days of receipt or require CONTRACTOR to meet with OAR and CxSP within five days of receipt to revise and incorporate unaddressed revisions and/or comments. CONTRACTOR shall be assessed reasonable fees and expenses incurred by CxSP for these meetings.

C. Upon completion of training, submit two complete training manuals for OWNER's use and one CD-ROM including materials in the complete training manual in the Adobe PDF format. Each manual shall contain specific training and instruction manuals and hand-outs for the following designated end-users:

1. School Faculty and Administration.

2. School Plant Manager.

3. OWNER Maintenance and Operations (M&O) Personnel.

D. Qualification Data: Three weeks prior to start of training, CONTRACTOR shall submit Letters of Qualifications and Project Lists for persons and firms providing instruction including:

1. Training Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel and end-users in training program similar to that required for this Project, and who has a record of successful training performance.

2. Training Instructor Qualifications: Instructor shall be factory-authorized service representative, experienced in operation and maintenance procedures and training for each system, subsystem or piece of equipment.

3. References: The name of owner and the name and telephone number of the plant manager and maintenance supervisor on three similar projects for reference.

E. Attendance Record: For each training module, submit the proposed list of participants, sign in sheets and length of instruction time a minimum of 15 days prior to start of training of the module.

F. Evaluations: For each participant and for each training module, submit results and documentation of performance-based tests a minimum of seven days following completion of training of each module.

G. Demonstration and Training Video: CONTRACTOR shall video record each classroom training and demonstration session and submit a copy on CD-ROM or DVD in a format compatible with MS Windows Media Player at end of each training module. CONTRACTOR shall include a copy of manufacturer training video materials presented during training and demonstration session.

1.04 COORDINATION

A. Coordinate instruction schedule with the OAR, CxSP, and OWNER's M&O personnel. Adjust schedule as required to reasonably accommodate the schedules of participants and to minimize disrupting OWNER operations.

B. Coordinate with instructors, including providing notification of scheduled dates, times, length of instruction time and course content.

C. Coordinate content of training modules with content of approved Emergency Manual and Operations and Maintenance Manual. Do not submit instruction program until manual has been reviewed and accepted by the OAR.

1.05 INSTRUCTION PROGRAM

A. Program Structure: Develop instruction program that includes individual demonstration and training modules for the operation, maintenance, minor repair (completion in under two hours) and calibration of systems and components in the system as required by Section 01 9113, Divisions 22, 23 and Division 26 and as specified in Part 3 of this Section, "DEMONSTRATION AND TRAINING".

B. Training Modules: Develop learning objective and teaching outline for each module, specific and as applicable, for the following OWNER personnel:

1. School Faculty and Administration.

2. School Plant Manager.

3. Operations and Maintenance.

C. Include description of specific skills and knowledge that participant is expected to master.

D. For each module, include instruction for the following:

1. Basis of System Design (for OWNER Operations and Maintenance Personnel), Operational Requirements and Criteria, including, but not limited to:

   a. System, subsystem and equipment descriptions.

   b. Performance and design criteria if CONTRACTOR is delegated design responsibility.

   c. Operating standards.

d. Regulatory requirements.

e. Equipment function.

f. Operating characteristics.

g. Limiting conditions.

h. Performance curves.

2. Documentation (for OWNER Operations and Maintenance Personnel and School Plant Manager): Review in detail the following documentation:

a. Emergency manuals.

b. Operations manuals.

c. Maintenance manuals.

d. Project Record Documents.

e. Identification systems.

f. Warranties.

g. Maintenance service agreements and similar continuing commitments.

3. Emergencies (for OWNER Operations and Maintenance Personnel and School Plant Manager): Review, without limitation, the following, as applicable:

a. Instructions on meaning of warnings, trouble indications, and error messages.

b. Instructions on stopping.

c. Shutdown instructions for each type of emergency.

d. Operating instructions for conditions outside of normal operating limits.

e. Sequences for electric or electronic systems.

f. Special operating instructions and procedures.

4. Operations (for OWNER Operations and Maintenance Personnel and School Plant Manager): Review, without limitation, the following as applicable:

a. Startup procedures.

b. Equipment or system break-in procedures.

c. Routine and normal operating instructions.

d. Regulation and control procedures.

e. Control sequences.

f. Safety procedures.

g. Instructions on stopping.

h. Normal shutdown instructions.

i. Operating procedures for system, subsystem or equipment failure.

j. Seasonal and weekend operating instructions.

k. Required sequences for electric or electronic systems.

l. Special operating instructions and procedures.

5. Adjustments (for OWNER M&O Personnel): Review, without limitation, the following as applicable:

a. Alignments.

b. Checking adjustments.

c. Noise and vibration adjustments.

d. Economy and efficiency adjustments.

6. Troubleshooting (for OWNER M&O Personnel): Review, without limitation, the following as applicable:

a. Diagnostic instructions.

b. Test and inspection procedures.

7. Maintenance (for OWNER M&O Personnel and Plant Manager): Review, without limitation, the following, as applicable:

a. Inspection procedures.

b. Types of cleaning agents to be used and methods of cleaning.

c. List of cleaning agents and methods of cleaning detrimental to product.

d. Procedures for routine cleaning.

e. Procedures for preventative maintenance.

f. Procedures for routine maintenance.

g. Instruction on use of special tools.

8. Repairs (for OWNER M&O Personnel): Review, without limitation, the following as applicable:

a. Diagnostic instructions.

b. Repair instructions.

c. Disassembly; component removal, repair and replacement and reassembly instructions.

d. Instructions for identifying parts and components.

e. Review of parts needed for operation and maintenance.

9. Faculty Member Training:

a. Manual for the basic operation/control of the HVAC room sensor/thermostat and lighting controls.

b. Organizational chart structure, to be completed by OWNER, for repair or emergency requests for the systems including contact information of the Plant Manager.

1.06 PREPARATION

A. Training Facilitator: Engage qualified training facilitator no later than 120 days prior to start of training to prepare instruction program and training modules, to coordinate instructors, and to coordinate between CONTRACTOR, OAR and CxSP for number of participants, instruction times and location.

B. Training Instructor: Engage qualified training instructors to instruct OWNER's personnel to adjust, operate and maintain systems, subsystems and equipment not part of a system no later than 30 days prior to start of training of assigned modules.

C. Scheduling: Provide instruction at mutually agreed on times.

1. Schedule training with OWNER, through OAR, with at least two weeks advance notice.

2. Schedule training to conform to personnel availability at Site.

3. Conduct training(s) after the execution of commissioning Pre-functional and Functional Tests are completed.

4. Base duration of training on hours specified in the applicable specifications or minimums defined in Article 1.08.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of oral, written, demonstration, or combination of oral, written, and demonstration based testing.

E. Demonstration and Training Video: Record each training module separately. Include classroom instructions and demonstrations, board diagrams and other visual aids, excluding attendee practice or testing.

1. Make demonstration and testing videos at Site to ensure video is representative of installed system. As part of training, devote one lesson plan to reviewing of video to allow new employees to view the video recordings at their own convenience and be able to operate the video system without need for instructor attendance.

2. At the beginning of each video recording for the training module, incorporate a chart presenting the learning objective and lesson outline.

F. In addition to technical training, attendees shall be trained on how to provide future training for new employees.

G. Familiarize OWNER staff regarding CAL/OSHA Title 8, section 5142 Requirements.

H. Cleanup: Collect excess copies of educational materials and give to OAR. Remove instruction equipment. Restore systems and equipment to condition existing just before commencing training.

1.07 OPERATIONS AND MAINTENANCE MANUALS

A. CONTRACTOR shall direct Subcontractors to compile and prepare M&O Manuals and other required documentation for the equipment and systems that are provided and/or installed per their scope of work for submittal to OAR prior to project closeout.

B. The OAR shall receive a copy of the Operations and Maintenance manuals prior to initiation of demonstration and training for review and acceptance or rejection.

C. Operations and Maintenance manuals shall meet the respective requirements of Divisions 22,23 and Division 26, and Section 01 7700; and comply with the following:

1. Quantity: Two.

2. Format: 8 ½ by 11 loose leaf binders. Each binder shall be clearly labeled on the spine and meet the requirements of Section 01 7700. Dividers shall be made of card stock with permanently marked index tabs to separate each section and sub section. Tab labels shall not be handwritten. Binders will meet other formatting requirements as outlined in DIVISIONS 02 to 49, as applicable.

3. Contents: There shall be a title page and table of contents at the beginning of each binder. The table of contents shall be an outline that identifies the equipment or systems documentation included in the binder and references the specification sections relating to the equipment and systems that are being included in each part of the binder. Each part of the binder shall contain the information described below, in the following order.

a. CONTRACTOR. The first page shall contain the name, address, and telephone number of the manufacturer and installing CONTRACTOR, as well as the 24-hour number for emergency service for each piece of equipment identified in this section.

b. Preventive Maintenance Instructions. This section shall list the location of preventative maintenance instructions. The list shall show the piece of equipment, the Operations and Maintenance document name, and the O&M document page number that contains the instructions.

c. Submittal and Product Data. This section shall include product data not covered by manufacturer's Operations and Maintenance instructions and associated shop drawings.

d. Warranty and Service Contracts. This section shall include the following for each piece of equipment, as applicable:

1) Copy of the equipment warranty information provided as part of Section 01 7836.

2) Additional Warranties in accordance with Warranty requirements in DIVISIONS 02 to 49, as applicable. Equipment Warranties shall clearly list requirements to maintain the Warranty in effect, conditions or acts that would invalidate or void the Warranty, and Warranty expiration date.

3) Service contracts issued. Contracts shall clearly indicate contract dates and scope of work included.

e. Operation and Maintenance Instructions. These shall be the written manufacturer's maintenance and operating instructions with the model number and features of the installed equipment or system clearly identified. This section shall include applicable data on the following:

1) Installation, startup, and break-in instructions.

2) Starting, normal shutdown, emergency shutdown, manual operation, seasonal changeover and normal operating procedures and data, including any special limitations.

3) Operations and Maintenance and installation instructions that were shipped with the unit.

4) Preventative maintenance and service procedures and schedules.

5) Troubleshooting procedures.

6) A parts list, edited to omit reference to items which do not apply to this installation.

7) A list of any special tools required to service or maintain the equipment.

8) Performance data, ratings, and curves.

f. Control Drawings. This section contains controls drawings and the final sequence of operations, set points, and schedules as set during the Commissioning Process. If shop drawings, portions of the project manual, or record drawings clearly show this information, a copy of this information may be inserted. Otherwise, original drawings shall be generated and included in this section.

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

1. Final report containing an explanation of the methodology, assumptions, test conditions, and the results in a clear format with designations of all uncommon abbreviations and column headings.

2. The Balancing Subcontractor shall mark on the drawings where all traverse and other critical measurements were taken and cross reference the location in the Test and Balance report.

1.08 DEMONSTRATION AND TRAINING SCHEDULE

A. The following applies to the minimum duration of demonstration and training provided District Maintenance and Operations Personnel.

1. Heat Generation:

a. Boilers: Minimum six hours demonstration and training [***Replace with specification required training time when available***].

b. Feedwater Equipment: Minimum four hours [***Replace with specification required training time when available***].

c. Pumps: Minimum four hours [***Replace with specification required training time when available***].

d. Steam Distribution Piping: Minimum two hours [***Replace with specification required training time when available***].

e. Water Distribution Piping: Minimum two hours [***Replace with specification required training time when available***].

2. Refrigerant Systems:

a. Chillers: Minimum six hours [***Replace with specification required training time when available***].

b. Cooling Towers: Minimum six hours [***Replace with specification required training time when available***].

c. Condensers: Minimum four hours [***Replace with specification required training time when available***].

d. Pumps: Minimum four hours [***Replace with specification required training time when available***].

e. Distribution Piping: Minimum two hours [***Replace with specification required training time when available***].

3. HVAC Systems:

a. Air-handling Equipment: Minimum six hours [***Replace with specification required training time when available***].

b. Air Distribution Systems: Minimum four hours [***Replace with specification required training time when available***].

c. Terminal Equipment and Devices: Minimum six hours [***Replace with specification required training time when available***].

4. HVAC Instrumentation and Controls: Minimum sixteen hours [***Replace with specification required training time when available***].

5. Lighting Systems and Controls: Minimum four hours [***Replace with specification required training time when available***].

PART 2 – PRODUCTS – N/A

PART 3 – EXECUTION – N/A

END OF SECTION

SECTION 02 2600

ABATEMENT OF HAZARDOUS MATERIALS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Abatement of hazardous materials identified in the Upcoming Hazardous Materials Assessment Report, except for underground storage tanks, contaminated soil or groundwater. Furnish labor, materials, supplies, and incidentals required, protect Project site personnel and the surrounding public from exposure to potentially hazardous substances, and prevent the spread of potentially contaminated or hazardous substances.

2. The furnishing of labor, supervision, materials, equipment, tools, permits, manifesting, and services required in the characterization, transportation, and disposal of identified or suspected hazardous substances. The suspect substance may be in drums, containers, stockpiled, or may exist as debris piles on the Project site.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 02 4116 - Demolition

3. Section 02 8213 - Asbestos Abatement

4. Section 02 8333 - Lead Abatement and Lead Related Construction Work.

C. Regulatory Requirements shall include, but not be limited to: Comply with laws, ordinances, codes, rules, and regulations of the Federal, State and local authorities having jurisdiction over any of the Work specified herein. Comply with federal EPA and state Department of Transportation regulations for shipping of hazardous substances to offsite disposal facilities. Comply with any regulatory requirements imposed by the treatment, storage, and disposal facility. Regulations pertaining to the transport and disposal of hazardous substances/materials include, but are not limited to, the following:

1. Department of Transportation 49 CFR 172 through 179.

2. Department of Transportation 49 CFR 387 (46 FR 30974, 47073).

3. Department of Transportation DOT-E 8876.

4. Environmental Protection Agency 40 CFR 136 (41 FR 52779).

5. Environmental Protection Agency 40 CFR 261, 262 and 761.

6. Resource Conservation and Recovery Act (RCRA).

D. Any transporter of hazardous substances shall be licensed in the state in which handling and transportation will take place in accordance with applicable regulations.

E. Comply with OSHA (Occupational Safety and Health Administration) Standards and Regulations contained in Title 29 Code of Federal Regulations, Part 1910.120 "Hazardous Waste Operations and Emergency Response."

F. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.02 QUALITY ASSURANCE

A. The Work of this Section shall be performed by an entity possessing the following minimum qualifications:

1. Contractors License in the state where the Work is performed, supplemented by a Hazardous Waste specialty license, where applicable (i.e., California).

2. MCS 90 Endorsement on Liability Insurance.

3. Pollution Liability Insurance in the amount of $2,000,000 occurrence.

4. Forty-hour OSHA Training and site-specific health and safety plan for its employees proposed to work at the Project site as defined in 29 CFR 1910.120.

5. A Comprehensive Quality Assurance Plan on file with the California Environmental Protection Agency.

6. Project site personnel shall wear personal protective equipment and protective clothing consistent with the levels of protection required for this Work as specified by OSHA (29 CFR Part 1910.120).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 ABATEMENT OF HAZARDOUS MATERIALS

A. Abate hazardous materials including hazardous materials identified in the Phase I Assessment Report.

B. The Work of this section does not include the removal of underground storage tanks, contaminated soil or groundwater, unless specifically authorized in writing by the OAR.

3.02 CONTAINMENT OF RELEASED SUBSTANCES

A. If a hazardous material appears to be leaking or otherwise spreading, contain the release of the material. Provide measures to prevent the release of the material to the environment and protect Project site personnel, adjacent properties and occupants, and the general public from potential exposure.

B. During the course of substance containment or evacuation of Project site personnel, protect personnel (onsite workers, non-workers, or the general public) from contact with or exposure to the released substances.

C. The abatement or evaluation of any suspected hazardous material shall only be performed by properly trained and/or certified personnel.

3.03 HEALTH AND SAFETY

A. In an emergency or imminent hazard situation the health and safety of personnel on or near the Project site are the responsibility of the Work of this section. Immediately notify the Owner office of Environmental Health and Safety (OEHS) and the OAR designated representative of the Owner Consultant. Owner representatives will notify Federal, State and Local regulatory authorities, if required.

B. Project site personnel or members of the general public who have been exposed to or have come in contact with any hazardous materials or chemicals shall be immediately transported to the nearest hospital.

3.04 TESTING, TRANSPORT, AND DISPOSAL OF HAZARDOUS SUBSTANCES

A. Collect one composite sample from each media type (solid, liquid, or sludge) of potentially hazardous substance stored in drums, stockpiled, or otherwise identified at the Project site for the purposes of obtaining approvals for proper transport and disposal of the suspect materials. Submit analytical results to a representative of the Owner Consultant, as designated by the OAR.

B. If required, overpack any leaking or deteriorated drums to prevent leaks or spills, and pack small 5-gallon containers into larger new 55-gallon drums. Cover solid waste materials and stockpiled soils with an HDPE liner to prevent storm water runoff from contaminating surrounding areas.

C. Prepare manifests, material profiles, and submit lab analysis for drums/containers and any other documentation required by the receiving facility for signature by a representative of the Owner Consultant and/or Owner, as designated by the OAR. Copies of waste profiles, manifests, and disposal documentation shall be submitted to the OAR designated representative of the Owner, prior to disposal and/or transporting of hazardous substances.

D. Coordinate waste sampling and analysis requirements with the disposal facility and properly complete profiling and transport documents prior to loading and transport.

E. A State registered “Hazardous Waste Hauler” shall transport the waste to a lawfully permitted and Owner approved facility.

F. Prior to transport, a copy of the hazardous waste manifest shall be transmitted by facsimile, through the Project site Owner Consultant, to the Owner Office of Environmental Health and Safety (OEHS) for review and approval. The manifests shall list the generator’s name as “Los Angeles Unified School District” and the mailing address as “1449 S. San Pedro Street, Los Angeles, CA 90015”. The OAR designated representative of the Owner Consultant shall provide the Project site specific generator’s EPA ID # which shall be included on the manifest. Attach the land disposal restriction (LDR) form to the manifest prior to submission to the Owner office of OEHS. The blue and yellow manifest copies and a copy of the LDR

form shall be mailed to the Owner office of OEHS at 1449 S. San Pedro Street, Los Angeles CA 90015. Other copies of the manifest and LDR shall be submitted to the waste transporter.

G. Load, handle, and transport 55-gallon drums and other waste containers to the appropriate disposal facility in accordance with Federal and State regulations.

H. Transport documentation from the receiving facility verifying acceptance and receipt of drums/containers at the facility and sampling and associated test results shall be submitted to the representative of the Owner Consultant, as designated by the OAR, within fifteen days following receipt of hazardous substances to the disposal facility.

I. Materials identified as hazardous wastes under RCRA are not permitted to remain at the Project site more than 30 days after being deemed to be a hazardous waste. During this period of Project site storage, provide precautions to contain and prevent the release of hazardous or potentially hazardous materials to the environment.

END OF SECTION

SECTION 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.

3. Section 01 5000 - Construction Facilities and Temporary Controls.

4. Section 01 7329 - Cutting and Patching.

6. Division 22 –- Plumbing.

7. Division 23 –- HVAC.

8. 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 OAR, 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 OAR. 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. Refer to Section 01 5000 - Construction Facilities and Temporary Controls.

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 OAR.

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 02 8213

ASBESTOS ABATEMENT AND ASBESTOS RELATED DISTURBANCE

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Abatement of building and/or structure related Asbestos.

2. Removal of building and/or structure related Asbestos.

3. Disturbance of building and/or structure related Asbestos.

B. Related Requirements:

1. Division 01 - General Requirements.

2. U.S. Environmental Protection Agency Regulations for Asbestos (Title 40, Code of Federal Regulations, Part 61, Subparts A and B, and Part 763, Subpart E.)

3. Title 8, Article 4, California Code of Regulations Construction Industry Safety Orders, Section 1529 "Asbestos" or current revised California regulations.

4. South Coast Air Quality Management District (SCAQMD) Rule 1403.

1.02 SECTION DEFINITIONS AND ACRONYMS

A. Abatement – Procedures to control fiber release from Asbestos Containing Materials or Asbestos Containing Construction Materials. Includes Removal, Encapsulation, Enclosures, Repair, Demolition, and Renovation activities but does not include Asbestos Related Disturbance.

B. AHERA - Asbestos Hazard Emergency Response Act, 40 CFR, Part 763, Subpart E, and subsequent amendments.

C. Air Filtration and Ventilation System - A portable exhaust system, equipped with HEPA filtration, and capable of maintaining a constant air flow into a Regulated Area from adjacent areas and exhausted outside the Regulated Area.

D. Amended Water - Water to which a surfactant (wetting agent) has been added.

E. ANSI - American National Standards Institute.

F. Asbestos - Means the asbestiform varieties of chrysotile (Serpentine); crocidolite (Riebecktite); amosite (cummingtonitegrunerite); anthophyllite; tremolite; and actinolite.

G. Asbestos Containing Construction Material (ACCM) – Means any manufactured construction material which contains more than one tenth of one percent (0.1 percent) Asbestos by weight.

H. Asbestos Containing Material (ACM) – Means any material containing more than one-percent (1 percent) Asbestos.

I. Asbestos Containing Waste (Non-hazardous) – Non-Friable Asbestos Containing Material including, but not limited to, floor covering, roofing materials and cementitious materials requiring disposal.

J. Asbestos Containing Waste (Hazardous) – Friable Asbestos Containing Materials and Asbestos contaminated objects and debris requiring disposal.

K. Asbestos Related Disturbance – is the drilling, coring, removal or similar disturbance of ACCM or ACM not to exceed three square feet in any one opening and not to disturb 100 square feet or greater cumulatively on any one project (contract).

L. ASTM - American Society for Testing and Materials.

M. Building ID Number or Code - A six digit alphanumeric identification code assigned to each building on an Owner site, also referred to as the insurance code, ID number or similar terms.

N. Bulk Samples - Samples of building or other materials collected for analysis to determine the presence and quantities of Asbestos.

O. Class I, II, III, and IV asbestos work has the meaning as defined in California Code of Regulations Title 8, Section 1529.

P. Clean Room - An uncontaminated area or room, which is a part of the worker Decontamination Enclosure System with provisions for storage of worker's street clothes and clean protective equipment.

Q. Competent Person - Has the same meaning as defined in the California Code of Regulations Title 8, as it relates to, "Competent Person."

R. Controlled Disturbance – An activity by which a contractor disturbs an asbestos containing material or an asbestos containing construction material using the work practices allowed for in this specification and in compliance with regulatory limitations.

S. Curtained Doorway – A device to allow ingress and egress from one room to another while permitting minimal air movement between the rooms, typically constructed by placing two overlapping sheets of plastic over an exiting or temporarily framed doorway, securing each along the top of the doorway, securing the vertical edge of one sheet along one vertical side of the doorway and securing the vertical edge of the other sheet along the opposite vertical side of the doorway. Other effective designs may be submitted for review.

T. Decontamination – The process of eliminating Asbestos contamination from building surfaces, objects, and property, by cloths, mops, or other utensils dampened with water and disposed of afterwards as Asbestos contaminated waste.

U. Decontamination Enclosure System – Means an enclosed area, which is adjacent and connected to the Regulated Area, consisting of an Equipment Room, Shower Room, and Clean Room for the Decontamination of workers, materials, and equipment contaminated with Asbestos.

V. Demolition - The wrecking or taking out of any load supporting structural member of a facility together with any related handling operations.

W. DOSH - Division of Occupational Safety & Health or Cal/OSHA.

X. DOT – Department of Transportation.

Y. DTSC – Department of Toxic Substances Control.

Z. Encapsulating Material - A liquid material applied to Asbestos Containing Materials which controls the possible release of Asbestos fibers from the material either by creating a membrane over the surface (bridging agent) or by penetrating into the material and binding its components together (penetrating Encapsulating Material).

AA. Encapsulation - The application of an Encapsulating Material to Asbestos Containing Materials to prevent the release of Asbestos fibers into the air.

BB. Enclosure - The construction or application of an airtight, impermeable, permanent barrier around Asbestos Containing Material to control the release of Asbestos fibers into the air.

CC. Equipment Room - A room within the worker Decontamination Enclosure System with provisions for storage of used clothing and equipment and for controlled transfer of materials and equipment into and out of the regulated area.

DD. Facility Component – Means any part of a facility including equipment.

EE. FETU - Facilities Environmental Technical Unit.

FF. Fixed Object - A piece of equipment, furniture, or improvement in the Work area, which cannot be removed from the Work area.

GG. Friable Asbestos - Asbestos Containing Material which, when dry, can be crumbled, pulverized or reduced to a powder by hand pressure or as defined by current regulations.

HH. Glove Bag Technique - A method with limited applications for removing small amounts of Asbestos Containing Material from short piping runs, valves, joints, elbows, and other non-planar surfaces in a Work area. The glove bag assembly is a manufactured or fabricated device consisting of a glove bag (typically constructed of 6 mil transparent polyethylene or polyvinyl chloride plastic), two inward projecting long sleeves gloves, an internal tool pouch, and labeled for Asbestos waste. The glove bag is constructed and installed in such a manner that it surrounds the object or material to be removed and contains asbestos fibers released during the process. Workers who are permitted to perform the Glove Bag Technique shall be thoroughly trained, experienced, and skilled in this method.

II. Hazardous Waste - Means Friable Asbestos generated and prepared for waste disposal. Does not include non-friable material or materials containing one-percent or less of Asbestos as determined by PLM and/or the point counting method.

JJ. HEPA Filter - Means a filtering system capable of trapping and retaining at least 99.97 percent of mono-dispersed particles 0.3 microns in diameter or larger. For respirators this shall include NIOSH rated P-100 cartridges only.

KK. HEPA Vacuum - A vacuum system furnished with HEPA filtration.

LL. High Volume Vacuum - A vacuum system with the capacity to collect material through a four inch diameter hose a minimum distance of 150 feet. This system shall be furnished with HEPA Filter at the air exhaust port and water applicators within the hopper.

MM. HVAC – Heating, Ventilation, and Air Conditioning System.

NN. Location Code - Refers to a unique four digit numeric code assigned by the Owner to each of its Project sites.

OO. Lockdown Coat – A material applied to surfaces where Asbestos has been completely removed. The manufacturer shall determine the concentration of this material.

PP. Member – A component part of a structure complete in itself.

QQ. Movable Object - A portable piece of equipment or furniture in the Work area, which can be removed from the Work area.

RR. NESHAP - National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61).

SS. NIOSH - National Institute for Occupational Safety and Health.

TT. Outside Air - Air outside of buildings and structures.

UU. Owner Consultant (OC) - Refers to the firm, company or individual designated by the Owner.

VV. PCM - Phase Contrast Microscopy as it relates to clearance air, personnel exposure assessment, and ambient air monitoring. This procedure must follow the NIOSH Method 7400, Asbestos Fibers by PCM.

WW. PLM - Polarized Light Microscopy used for bulk sample analysis with dispersion staining for the determination and quantifying of Asbestos in Bulk Samples building materials.

XX. Regulated Area - Designated rooms, spaces or areas of the Project in which asbestos Abatement actions are to be performed or which may become contaminated as a result of Abatement activities. A contained Work area is a Work area, which has been sealed and furnished with a Decontamination Enclosure System. A non-contained Work area is an isolated or controlled access Work area, which has not been sealed or furnished with a Decontamination Enclosure System.

YY. Removal – Means operations where ACM and/or PACM is removed or stripped from structures or substrates including Demolition.

ZZ. Renovation – Means the modifying of any existing structure, facility, or portion thereof.

AAA. SCAQMD – South Coast Air Quality Management District.

BBB. Shower Room - A room between the Clean Room and the Equipment Room in the worker Decontamination Enclosure System furnished with hot and cold running water controllable at the tap, and suitably arranged for complete showering during Decontamination.

CCC. Small Scale Short Duration – Such work not to exceed amounts greater than those which can be contained in a single glove bag or may not exceed amounts which can be contained in a single prefabricated mini-enclosure. Such an enclosure shall conform spatially and geometrically to the localized work area, in order to perform its intended containment function, and as completely defined in 40CFR, 763, Subpart E, Appendix C.

DDD. Staging Area - Areas near the Waste Transfer Airlock where containerized Asbestos waste is temporarily placed prior to permanent removal from the Work area.

EEE. Surfactant - A chemical wetting agent added to water.

FFF. TEM - Transmission Electron Microscopy as defined for Asbestos clearance air monitoring within AHERA. This procedure must follow the NIOSH Method 7402, Asbestos Fibers by TEM.

GGG. TSI - Thermal System Insulation as defined in AHERA.

HHH. USEPA or EPA – United States Environmental Protection Agency.

III. Visible Emissions - Any emissions from a known or suspected Asbestos Containing Material that is visually discernible.

JJJ. Waste Transfer Airlock - A Decontamination system provided for transferring containerized waste from inside to outside of the Work area.

1.03 POLICIES AND PROCEDURES

A. The Owner has a zero tolerance policy for uncontrolled Asbestos releases during construction or Abatement Work. An Asbestos release requiring an emergency response is any uncontrolled release of Asbestos Containing Construction Materials. The Owner shall be immediately notified of such uncontrolled releases.

B. Pre-qualified Asbestos Abatement Subcontractors are not permitted to subcontract any Abatement work to a lower tier Subcontractor without the prior written approval of the Owner.

C. Where ACM is damaged or disturbed, except during Controlled Disturbance or Abatement, Work in that room shall cease, the room be vacated immediately, the Owner Consultant notified of the disturbance with corrective action provided as required by the Owner Consultant.

1.04 ROLES AND RESPONSIBILITIES

A. Roles and Functions:

1. Coordinate the Work of this section directly with the Owner and/or Owner Consultant.

2. Work under this section shall be performed in strict accordance with applicable Federal, State, and Local regulations, standards, and codes governing asbestos Abatement and any other Work performed in conjunction with the Asbestos Abatement Work.

3. The most recent edition of any relevant regulation, standard, document, or code is in effect. Where conflict among the requirements or with this Specification exists, the most stringent requirement shall be provided.

1.05 SITE SECURITY

A. The Work area shall be restricted to authorized, trained, and protected personnel. A list of authorized personnel shall be established by the Owner Consultant prior to commencement of the Work and posted at the entrance of the Regulated Area.

B. Report to the Owner Consultant any unauthorized entry into the Regulated Area. Following notification, a written report of the incident shall be provided to the Owner Consultant.

C. A logbook shall be maintained at the entrance of the Regulated Area. Persons entering the Regulated area shall record their name, company affiliation, time in, and time out for each entry and exit.

D. Access to the contained area shall be through the worker Decontamination Enclosure System or other room established when worker Decontamination Enclosure System is not required. Other means of access shall be blocked or locked to prevent entry to or exit from the Work area. The only exceptions are the waste pass-out airlock, which shall be sealed except during the Removal of containerized Asbestos waste from the Work area, and emergency exits in case of fire or accident. Emergency exits shall be operable from inside the Work area; however they shall be sealed with polyethylene sheeting and tape.

E. Maintain Regulated Area security during Abatement Work. Regulated Areas and ancillary equipment accessible to non-authorized personnel shall be protected from unauthorized access by constructing a minimum barrier of 3/8 inch CDX plywood supported by 2 by 4 studs, 16 inches on center. Height shall be as required to safely access Regulated Area. An access door shall be provided with hasp and padlock sufficient to prevent unauthorized entry. A key shall be provided to the Owner and Owner Consultant. Required barriers within an occupied building shall be furnished with sheathing as required by state and local fire protection regulations.

F. The protective barrier for a High Volume Vacuum shall be a minimum of eight feet in height. Barriers for these systems may be constructed of chain link type fencing instead of the specified barriers. Such fencing, if provided, shall be covered with an opaque covering resistant to environmental conditions. This barrier system shall be maintained at times while the enclosed equipment is on the Project site.

G. Unless otherwise specified, remove barriers upon completion of the Work of this section. Repair and/or replace to original condition, damage resulting from installation, use, and removal of the barriers.

1.06 EMERGENCY PLANNING

A. Emergency planning and procedures shall be developed, submitted, reviewed, and agreed to by the Owner prior to the commencement of Abatement Work.

B. Emergency procedures shall be provided in the written languages understood by employees working on the Project and shall be prominently posted at the entrance of the Decontamination Enclosure System. Prior to entering the Work area, parties must read and sign these procedures

to acknowledge receipt and understanding of the Work site layout, location of emergency exits, and emergency procedures.

C. Emergency planning shall consider the effects of fire, explosion, toxic atmospheres, electrical hazards, slips, trips and falls, confined spaces, and heat related injury. Develop and provide written procedures and training to employees.

D. Employees shall be trained in evacuation procedures in the event of workplace emergencies.

E. In the event of non-life threatening situations requiring medical treatment, injured or otherwise incapacitated employees shall decontaminate following normal procedures with assistance from fellow workers if necessary, before exiting the Work area.

F. In the event of life threatening injury or illness requiring immediate medical treatment, worker Decontamination shall be given minimum priority. Provide measures to stabilize the injured worker, remove them from the Work area and secure proper medical treatment.

G. Telephone numbers of emergency response personnel shall be prominently posted at the entrance of the Decontamination Enclosure System along with the location of the nearest telephone. In addition to the 911 emergency number, post the address and telephone number of the nearest emergency medical services provider.

H. Provide at least one employee on the Project site at times during progress of Abatement work that is trained and certified in first aid and cardiopulmonary resuscitation (CPR). This employee shall be identified by name and proof of training shall be provided to the Owner Consultant prior to the commencement of the Work of this section.

I. Provide at least one 4A/60BC dry chemical extinguisher in the Equipment Room and one at each corner of contained areas in excess of 1,000 square feet. Workers shall be trained in the proper operation of fire extinguishers.

J. Emergency exits shall be provided and clearly marked with arrows or other clearly visible markings to permit easy identification from anywhere within the Work area. Exits shall be secured to prevent access from uncontaminated areas while still permitting emergency egress. Exits shall be properly sealed with polyethylene sheeting, which can be cut to permit emergency egress. Emergency exits may lead through the worker Decontamination Enclosure, the waste removal airlock or other alternative exits as required by fire officials.

1.07 LICENSING

A. The Work of this section shall be performed by an entity duly licensed in the State of California in accordance with the provisions of Chapter 9 of Division 3 of the Business and Professions Code, as amended. The Abatement work of this section shall be performed by an entity holding a license with an “ABS” Asbestos Certification as issued by the Contractors State License Board.

B. The entity performing the Work of this section, other than Asbestos Related Disturbance involving less than 100 square feet shall be registered with the Department of Industrial Relations in accordance with the provisions of Section 6501.5 of the California Labor Code.

1.08 ASBESTOS RELATED REQUIREMENTS

A. Qualifications:

1. Comply with the provisions of the California Labor Code, Division 5, Part 1, as it pertains to safety in employment and the applicable provisions of Title 8, Chapter 4, Subchapters 1 through 21, California Code of Regulations (CCR) as it pertains to Occupational Safety and Health, and Subchapter 7, Section 5208 Article 4, and Section 1529, Asbestos regulations.

2. Where Electrical Work is required in a Regulated Area this work shall be performed as required in Division 16 and personnel who enter a Contained and Regulated Class I and II Asbestos work area are required to possess a current EPA certification as an Asbestos worker. Personnel who enter a Class III Asbestos Related Disturbance work area shall require personnel trained in accordance with AHERA Operations and Maintenance training requirements.

B. Abatement Activities:

1. The Asbestos Abatement work shall be performed by persons who comply with applicable Federal, State, and local regulations including AHERA certified training.

2. Supply labor, materials, services, insurance, permits, and equipment necessary to perform the Work in accordance with applicable Federal, State, and Local regulations and this Specification.

3. For Class I asbestos work, collect pre-Abatement air samples. Results shall be submitted prior to commencement of the Work of this section. Include location of Samples, name of air sampling professional, equipment, and methods utilized for sampling and analysis.

4. Submit weekly job progress reports detailing Abatement activities for Projects with schedules that exceed thirty days of Abatement work. Include review of progress with respect to previously established Milestones and schedules, major problems and action taken, injury reports, equipment breakdown, and air sampling results.

5. Within five workdays of transport and/or disposal, submit copies of transport manifests, disposal receipts, and weight certificates for Asbestos waste removed from the Work area during the Abatement process. Weight certificates shall indicate in pounds the net weight of waste disposed from the Project site as indicated on the manifest.

6. Submit copies on a daily basis of the Work site entry logbooks.

7. Submit logs on a weekly basis documenting filter changes on respirators, HEPA Vacuums, HEPA Filtered ventilation units, water filtration units, and other approved engineering controls.

8. Submit results of materials testing conducted during Asbestos Abatement work for purposes of utilization during such activities. (i.e., depth test, substitution materials, etcetera).

9. Where Decontamination Enclosure System is required, post at the entrance a list containing the names, addresses, and telephone numbers of the entity performing the Work of this section, designated Competent Person, the Owner and/or Owner

Consultant, the testing laboratory and any other personnel who may be required to access the Work area or perform services during the Abatement Work.

10. For employee review, post at the entry of the Work area a copy of the scope of Work, special conditions, the current standard Specifications, and the applicable prevailing wage.

C. Asbestos Related Disturbance:

1. The Asbestos Related Disturbance Work shall be performed by persons who comply with applicable Federal, State, and local regulations including AHERA certified training.

2. Within ten days of analysis, submit results of air sampling data collected for Cal/OSHA compliance air monitoring during the course of the Asbestos Related Disturbance (Class III asbestos work). If this data is used to discontinue use of employee protective equipment then the data shall be provided before discontinuing use of protective equipment.

3. Within five workdays of transport and/or disposal of Asbestos Containing Waste, submit copies of transport manifests and/or disposal receipts.

1.09 SUBMITTALS

A. Provide in accordance with Division 01 and this section.

B. Prior to commencement of the Asbestos Abatement work of this section, submit the following notices, documentation, Shop Drawings, and Product Data:

1. For Projects involving Asbestos Containing Materials 100 square feet or more, provide a typed written notification in accordance with Rule 1403 of SCAQMD and 40 CFR Part 61.146 of Subpart M to the SCAQMD, and to and in accordance with the Division of Occupational Safety and Health prior to start of the Work. For Projects within the geographical limits of Los Angeles City, provide an additional copy of the SCAQMD notice to the Los Angeles City Fire Department, marked "COURTESY COPY."

2. Submit to the Owner, satisfactory proof the required permits, site location, and arrangements for transport and disposal of Asbestos Containing Waste materials have been completed in accordance with California Health and Safety Code, Section 25143.7. Obtain and submit a copy of handling procedures and a list of protective equipment utilized for Asbestos disposal at the landfill.

3. Submit to the Owner satisfactory documentation that employees, including foremen, supervisors, and any other company personnel or agents who may be exposed to airborne Asbestos fibers or who may be responsible for any aspects of Asbestos Abatement work or Asbestos Related Disturbance have received adequate training that includes, at a minimum, information as described within this section and as required by AHERA.

4. Prior to commencement of Abatement Work, personnel required to construct and enter the Work area or handle containerized Asbestos Containing Materials shall have received adequate training, in accordance with the requirements of this Specification

and by 40 CFR, Part 763, Subpart E (AHERA) and Title 8, Section 1529, of the California Code of Regulations applies.

5. Special Project site training for equipment and procedures unique to this Project site shall be provided as required.

6. Training in emergency response and evacuation procedures shall be provided to personnel performing Asbestos Abatement work of this section.

7. Submit documentation from a physician certifying that employees are medically monitored and are physically capable of working while wearing the required respiratory protection without suffering adverse health effects as required by California D.O.S.H regulations. Where such documentation is required, the certification shall state that the employee or agent is approved to work with Asbestos and wear a respiratory protection without restrictions. Provide information to the examining physician about unusual conditions in the workplace environment that may impact on the employee's ability to perform Abatement Work activities.

8. Submit Shop Drawings for layout and construction of Decontamination Enclosure Systems and barriers for isolation of the contained Asbestos Abatement work area as detailed in this Specification and required by applicable regulations.

9. When used, submit manufacturer's certification that HEPA Vacuums, air filtration units, and other local exhaust ventilation equipment complies with ANSI Z9.2.

10. Submit Product Data verifying that air filtration devices (i.e., air filtration units and vacuums) for use on this project have been registered or certified, as applicable, in compliance with the SCAQMD Rules.

11. If rental equipment is to be furnished in Abatement Work areas or to transport Asbestos contaminated waste, written notification concerning the intended use of the rental equipment shall be provided to the rental agency with a copy submitted to the Owner.

12. Document NIOSH approvals for respiratory protective devices furnished as required by the Work. Include manufacturer certification of HEPA filtration capabilities for cartridges and filters.

13. Submit documentation of respirator fit testing for employees and agents entering the Abatement work area or areas where respiratory protection is required. This fit testing shall be performed in accordance with DOSH regulations.

14. Submit a Sample of forms to be used in documenting required items to be submitted and/or reviewed.

C. Provide other required submittals specified as part of the Work of this section.

1.10 PRE-ABATEMENT MEETING

A. Attend a meeting to be held prior to the commencement of Abatement Work. Attending this meeting shall be representatives of the Owner, the Owner Consultant if applicable, and the testing/monitoring personnel who shall actually participate in the testing/monitoring program.

Secure the attendance of the individual who will be the Project site Competent Person for the Abatement Work.

B. Included in the general preconstruction meeting will be a discussion of requirements and submittals for Asbestos Related Disturbance, where such applies.

C. At this meeting provide required submittals except for those to be submitted during progress of the Work. In addition, provide detailed information concerning:

1. Preparation of Work area and Shop Drawings. (Abatement Only).

2. Personal protective equipment, including respiratory protection and protective clothing. (Abatement, and Asbestos Related Disturbance if required).

3. Employees who will participate in the Project, including delineation of experience, training, and assigned responsibilities during the Work. (Abatement and Asbestos Related Disturbance).

4. Decontamination procedures for personnel, Work area, and equipment. (Abatement and Asbestos Related Disturbance).

5. Abatement methods and procedures to be provided. (Abatement Only).

6. Required air monitoring procedures (pre-Abatement and SCAQMD requirement **[Abatement Only]**, and Cal/OSHA mandatory **[Abatement and Asbestos Related Disturbance]**).

7. Procedures for handling and disposing of waste materials, including disposal facility. (Abatement and Asbestos Related Disturbance).

8. Procedures for final Decontamination and cleanup. (Abatement Only).

9. A sequence of Work activities and performance schedule. (Abatement Only).

10. Procedures for dealing with heat stress. (Abatement Only).

11. Emergency procedures. (Abatement Only).

1.11 CLOSE OUT DOCUMENTATION

A. Provide the following close out documentation:

1. Filter change logs for air filtration units, water filtration units and respirators. (Abatement Only).

2. Foreman's daily job reports. (Abatement Only).

3. Employee entry/exit logs for containment. (Abatement Only).

4. Visitor entry/exit logs for containment. (Abatement Only).

5. Manometer printout reports for applicable containment. (Abatement Only).

6. Air sample results for personnel (Abatement and Asbestos Related Disturbance).

7. Air Samples for Abatement Work areas and air filtration units. (Abatement Only).

8. Copies of hazardous and non-Hazardous Waste manifests. (Abatement and Asbestos Related Disturbance).

9. Hazardous Waste weight tickets. (Abatement Only).

10. Signed Daily Personnel Report Forms. (Abatement Only).

11. Signed code of conduct form from each employee working on a Project. (Abatement Only).

12. Signed asbestos Abatement Project Personnel Logs. (Abatement Only).

B. Receipt of the last workday attendance log and the daily personal monitoring results shall be submitted within two days upon completion of the Abatement Work of this section.

PART 2 – PRODUCTS

2.01 Materials and Equipment:

A. Materials

1. Products: The following products have been specifically approved for use as encapsulants/lock-down or bridging agents for Owner asbestos abatement and asbestos related construction projects and lead abatement and lead related construction projects. Products not approved by the Owner shall not be used.

a. Asbestos Removal Encapsulant: Foster 32-60 blue by Foster Products Corporation; removal, lock down or penetrating with dilution.

b. Asbestos Bridging Encapsulant: Foster 32-80 by Foster Products Corporation; for pipe covering and boiler lagging.

c. A-B-C Fiberspray 6410 and 6422SP by Fiberlock Technologies, Inc.; for coring, small jobs and gloves bags.

d. A-B-C Asbestos Binding Compound 6421, 6422 and 6423 by Fiberlock Technologies, Inc.; for general use, removal, lock down, penetrating and bridging; good for soils.

e. Fiberset PM 7475 clear by Fiberlock Technologies, Inc.; compatible with flooring.

f. Fiberset PM 7470 white by Fiberlock Technologies, Inc.; compatible with flooring.

g. Lag-Kote by Fiberlock Technologies, Inc.; multi-use product including fireproofing and thermal system insulation.

h. Lag-Klothe by Fiberlock Technologies, Inc.;water activated repair cloth for pipes, boilers and breaching.

2. General:

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

b. Store materials subject to damage off the ground, away from wet or damp surfaces, and under cover sufficient enough to prevent damage or contamination. Replacement materials shall be stored outside of the Abatement Work area until area is cleared for normal occupancy.

c. Damaged, deteriorating or previously used materials shall not be furnished and shall be removed from the Project site and legally disposed of.

d. A sufficient supply of disposable mops, rags, and sponges for Abatement Work area Decontamination shall be provided.

e. Unless otherwise specified, the Owner will provide water and power for construction purposes. Connect to existing system as required.

3. Asbestos Related:

a. Plastic, polyethylene sheeting or visqueen shall be a fire retardant type. Provide documentation from the manufacturer verifying compliance with this requirement.

b. Where a contained work area is required for Abatement Work, a minimum of two layers of 4-mil polyethylene sheeting shall be installed for walls. For floors and other installations, polyethylene sheeting of at least 6-mil thickness shall be furnished in sufficient widths to minimize the frequency of joints.

c. Method of attaching polyethylene sheeting shall be reviewed prior to installation and/or commencement of Abatement Work. Method of attaching polyethylene sheeting shall not cause damage to equipment, finish surfaces, or other property.

d. Polyethylene sheeting furnished for the Decontamination Enclosure System shall be opaque white or black in color and shall be a minimum of 6-mil thick.

e. Disposal bags shall be of 6-mil polyethylene, with the outer bag pre-printed with labels as required by SCAQMD and applicable Cal/OSHA and DOT requirements at a minimum.

f. Apply labels as per SCAQMD, Cal/OSHA, and DOT requirements for disposal containers.

g. Provide warning signs as required by CAL/OSHA.

h. Surfactant (wetting agent) shall be a material that, when tested, demonstrates a surface tension of 29 dynes/cm as tested in its properly mixed concentration, using ASTM method D1331 - Surface and Interfacial Tension of Solutions of Surface Active Agents. Where Work area temperature may cause freezing of the

Amended Water solution, the addition of approved antifreeze in a manufacturer recommended amount is permitted.

B. Equipment

1. General:

a. Equipment delivered to the Project site shall be free of Asbestos and/or fibrous debris. No equipment with Asbestos and/or fibrous debris in or on it is permitted on Owner properties.

b. Provide sufficient lighting to illuminate the Work area for safe visual working conditions and to clearly examine surfaces.

c. Provide a sufficient supply of scaffolds, ladders, lifts, and hand tools that meet applicable Federal, State, and local regulations.

d. Provide non-metallic dustpans, squeegees, and shovels for cleanup.

2. Asbestos Related:

a. A sufficient quantity of air filtration ventilation units furnished with HEPA filtration and operated in accordance with ANSI Z9.2-79 and EPA guidance documents shall be furnished to provide one workplace air change every 15 minutes creating -0.02 column inches of water pressure differential everywhere within the contained area when compared to the pressure outside the area. For small Enclosures and glove bags, a HEPA Filtered vacuum system may be furnished to provide the pressure differential. A log documenting the filter change history of each unit is required before use. Any unit without this log shall have filters changed and the unit decontaminated.

b. Provide a printable manometer for determining and recording the pressure differential within the isolated Work area as compared with the ambient environment. A printed record is required for the duration of the Project. The manometer shall operate 24 hours per day with a printed differential reading not to exceed fifteen minute intervals.

c. High volume vacuum equipment shall be provided during soil Removal operations unless otherwise specified.

d. Provide sprayers with pumps in a quantity capable of providing Amended Water in sufficient quantities to adequately wet materials during Asbestos Abatement activities. Provide spray bottles or adequate equipment necessary to keep materials impacted by Asbestos Related Disturbance adequately wet.

e. Non-skid footwear shall be worn by Abatement workers. Disposable clothing shall be adequately sealed to the footwear to prevent body contamination.

f. Provide other required safety equipment to workers and authorized visitors.

g. When roll-off disposal containers are delivered to a Project site, four wheels of each container shall be moved and rested upon a sheet of plywood no smaller than four-foot by four-foot by ¾ inch minimum.

2.02 EMPLOYEE PERSONAL PROTECTIVE EQUIPMENT

A. Respiratory Protection:

1. Where respirators are required these shall be provided for protection from particulate contaminants as required by the National Institute of Occupational Safety and Health.

2. The respirators provided shall furnish a protection factor as required by CCR Title 8, Section 1529 for the fiber concentration in the work area. When powered air purifying respirators are provided, a sufficient supply of charged replacement batteries, filters, and a flow test meter shall be provided in the Clean Room area. Air purifying respirators with dual HEPA Filters may be provided during Work area preparation activities.

3. Provide spectacle kits and eyeglasses for employees who wear glasses and must wear full-face respirators.

B. Fit Testing:

1. Workers must perform positive and negative air pressure fit tests each time a respirator is donned, whenever the respirator design so permits. Powered air purifying respirators shall be tested for adequate flow as specified by the manufacturer.

2. Workers shall be undergo a qualitative fit test in accordance with procedures detailed in the D.O.S.H. requirements for respirators provided to comply with the requirements of this Project. An appropriately administered quantitative fit test may be substituted for the qualitative fit test.

3. Where respirators are required, documentation of adequate respirator fit must be provided to the Owner Consultant.

4. No one wearing a beard shall be permitted to don a respirator and enter the Work area.

5. Where respirators are required, a minimum of two additional respirators of each type and training on their donning and use must be provided at the Work site for authorized visitors required to enter the Work area.

C. Protective Clothing:

1. Where protective clothing is required, full body disposable protective clothing, including head, body, and foot coverings, shall be provided to workers and authorized visitors in sizes adequate to accommodate movement without tearing.

2. Disposable clothing including head, foot, and full body protection shall be provided in sufficient quantities and adequate sizes for workers and authorized visitors.

3. A new suit shall be donned upon each entry to the Abatement Work area or area where the permissible exposure level will be exceeded.

4. Hard hats, protective eye wear, gloves, rubber boots and/or other footwear shall be provided as required for workers and authorized visitors. Safety shoes may be required and shall be provided.

PART 3 - EXECUTION

3.01 ABATEMENT PROCEDURES AND WORK AREA PREPARATION

A. Work Area Preparation

1. For Class I and II asbestos work, shut down and lock out heating, cooling and air conditioning system (HVAC) components that are located in, supply, or pass through the Work area. Seal intakes and exhaust vents in the Work area with tape and 6-mil polyethylene. Seal seams in any system components that pass through the Work area.

2. Provide and post signs at locations and approaches to the Regulated Area. The signs shall comply with Cal/OSHA regulations.

3. In conjunction with the Owner, shut down and lock out/tag out electric power to Class I and II asbestos work areas. Provide equipment for temporary power with ground fault interrupters and lighting sources. Temporary power sources and equipment shall comply with applicable electrical code requirements and Cal/OSHA requirements for temporary electrical systems. The Owner shall perform electrical connections of electrical cable and equipment provided as part of the Work of this section to existing Owner systems. The Owner shall pay for the costs of electric power consumed during performance of the Work of this section, unless otherwise noted.

4. For Class I and II asbestos work, clean and seal off windows, doorways, elevator openings, corridor entrances, drains, ducts, grills, grates, diffusers, skylights, and any other openings between the Abatement Work area and areas outside of the Abatement Work area with 6-mil polyethylene sheeting and tape prior to proceeding with required cleaning.

5. Clean Movable Objects within the Abatement Work area with a HEPA Filtered vacuum and wet cleaning methods. After cleaning, these objects shall be removed from the Abatement work area and carefully stored in a location designated by the Owner.

6. Clean Fixed Objects in the Abatement Work area with a HEPA Filtered vacuums and wet cleaning methods. Careful attention shall be given to machinery behind grills or gratings where access may be difficult but contamination is present. Cleaning of walls, floors, and ceilings behind fixed items is required. After cleaning, enclose Fixed Objects in 6-mil polyethylene sheeting and seal securely in place with durable tape.

7. Clean surfaces in the Abatement Work area with a HEPA Filtered vacuums and wet cleaning methods. Do not utilize any methods, such as dry sweeping or vacuuming, with equipment not furnished with HEPA Filters thereby creating airborne dust and particulates. Do not disturb Asbestos Containing Materials during this cleaning phase.

8. For Class I and II asbestos work, floors shall be covered with two layers of 6-mil (minimum) polyethylene sheeting. Additional layers of sheeting may be furnished as drop cloths for cleanup of bulk materials.

9. Polyethylene sheeting shall be sized and installed to minimize seams. If the floor area to be covered requires seaming, seams on successive layers of polyethylene sheeting shall be staggered a minimum of six feet between each seam to reduce the potential for water penetration into the existing flooring. Do not install seams at the junction between a wall and floor.

10. Polyethylene sheeting installed on a floor shall extend at least 12 inches up the sidewalls of the Abatement Work area.

11. Polyethylene sheeting shall be installed so as to prevent slippage between successive layers of installed material.

12. For Class I and II asbestos work, walls shall be covered with two layers of 4-mil minimum thickness polyethylene sheeting.

13. Polyethylene sheeting installed on a wall shall overlap floor sheeting by at least 12 inches beyond the wall/floor joint to provide a seal against water damage.

14. Polyethylene sheeting installed on a wall shall be adequately fastened to prevent it from falling away from the walls. Provide additional support/attachment when air filtration ventilation systems are provided.

15. For Class I and II asbestos work with porous, dropped, or perforated ceilings, those ceilings shall be covered with one layer 4-mil minimum thickness polyethylene sheeting.

16. Polyethylene sheeting installed on ceilings shall be adequately fastened to prevent it from falling away from the ceiling.

17. Provide one layer of 3-mil maximum, polyethylene sheeting (non-fire retardant type) for isolation of fire sprinkler devices. Installed taping shall not impede the normal function of the fire sprinkler device. Approved wire sprinkler guards shall be furnished in conjunction with isolation.

18. Where required, install and operate air filtration equipment to provide one air change in the Abatement Work area every 15 minutes. Openings made in the Enclosure System to accommodate these units shall be made airtight with durable tape and/or caulking as needed. If more than one unit is installed, they shall be turned on one at a time, checking the integrity of barriers after each unit is started. Insure that adequate power supply is available to satisfy the requirements of the air filtration units. Exhaust from these units shall be directed to the outside of the building whenever feasible. They shall not be exhausted into occupied areas of the buildings. Exhaust duct shall be extended from the Abatement Work area to the outside as required. Careful installation and daily inspections shall be performed to verify the exhaust ducts do not discharge into any areas of the building.

19. Once the Enclosure system is constructed and reinforced with air filtration units in operation as required, test the Enclosure for leakage utilizing smoke tubes. Repair, replace or reconstruct as required.

20. Following completion of the construction of polyethylene barriers and Decontamination Enclosure System, operate the air filtration units overnight to insure the barriers will remain intact and secured to walls and fixtures before beginning actual Abatement Work.

21. Commencement of the Work of this section shall not occur until:

    a. The entire containment system has been constructed and inspected by Owner Consultant in accordance with the required Shop Drawings.

    b. Air filtration units are functioning within the requirements of this section.

    c. Air filtration units are functioning within the requirements of this section.

    d. Pre-Abatement submittals, notifications, postings, and permits have been provided and reviewed by the Owner Consultant.

    e. Equipment for Abatement, Decontamination, and disposal are on the Project site.

    f. Worker training, respirator fit testing, and medical surveillance has been provided and reviewed by the Owner Consultant.

    g. A Notice to Proceed is transmitted by the Owner.

3.02 ASBESTOS RELATED DISTURBANCE WORK PRACTICES (Small-Scale, Short Duration – SSSD)

A. For Class III work, shut off air handling equipment to rooms work will occur in.

B. Provide and post signs at the entrance to the work area affected. The signs shall comply with Cal/OSHA regulations.

C. For Class III work clean the area immediately under the location to be disturbed.

D. For Class III work move any moveable furniture or objects from immediately beneath the area to be disturbed.

E. Provide an enclosure around the area of disturbance. This may include, but is not limited to:

    1. Mini-enclosure where not more than two persons may occupy for the purpose cutting holes up to three square feet in walls or ceilings.

    2. For drilling, coring, sawing or similar disturbance, an enclosure shall be placed over the area of disturbance of sufficient size to cover that area and contain the tools used. This can include drilling with a shroud, through a wet sponge, through a plastic enclosure, or similar designs which will ensure control of Asbestos fibers and other dust. Drilling or coring with the use of a vacuum collection device shall be equipped with a HEPA filtered vacuum.

F. Class III work performed without a HEPA vacuum collection device shall have surfaces of disturbance adequately wet to control fiber release.

G. Clean by wet method the surfaces disturbed, the enclosure device and/or materials used, and any tools used during the disturbance operation.

H. Clean up by wet method and/or HEPA vacuum any debris that may have escaped outside the enclosure required by this section.

3.03 DECONTAMINATION ENCLOSURE SYSTEM FOR ABATEMENT WORK

A. Decontamination Enclosure Systems shall be provided at locations where workers will enter or exit the Abatement Work area of Class I and II asbestos work prior to any other set up. Only one system at a single location for each Regulated Area is required. At least one individual shall be stationed at the entrance of each system at times Abatement Work is in progress.

B. These systems may consist of existing rooms outside of the Abatement Work area, if the layout permits, and that can be enclosed in polyethylene sheeting, and are accessible from the Abatement Work area. If this intended layout is not feasible, given existing site conditions, Enclosure systems may be constructed out of metal, wood, or plastic support as required.

C. Decontamination Enclosure Systems constructed at the Project site shall be furnished with 6-mil opaque white or black polyethylene sheeting or other approved materials for privacy. Detailed descriptions of portable, prefabricated units, if furnished, shall be submitted for review. Shop Drawings must include floor plan with dimensions, materials, size, thickness, plumbing, and electrical utilities.

D. Decontamination Enclosure System shall consist of at least a Clean Room, a Shower Room, and an equipment room, each separated from the other, from the Abatement Work area and from the non-Work area by "Z-flaps" at a minimum. The system shall be furnished with, at a minimum, two layers of 6-mil polyethylene sheeting on the floors, walls, and ceiling.

E. Clean room shall be of adequate size to accommodate the Abatement crew. Clean work clothes, clean disposable clothing, replacement filters for respirators, disposable towels, and other necessary items shall be provided for in adequate supply adjacent to the Clean Room. A location for posting notices shall also be provided adjacent to this area. When required, a lockable door shall be furnished to control access into the Clean Room from outside the Abatement Work area. Comfort lighting, heat, and electricity shall be provided as required. The Clean Room shall not be used for storage of tools, equipment, materials, or as office space.

F. Shower room shall contain one or more showers as required to adequately accommodate workers. Each showerhead shall be supplied with hot and cold water adjustable at the tap. The shower Enclosure shall be constructed to ensure against any kind of leakage. Provide an adequate supply of soap, shampoo, and disposable towels, available at times. Shower water shall be drained, collected, and progressively filtered through a system achieving a maximum particle size of 1.0 microns.

G. The Equipment Room shall be used for storage of equipment and tools at the end of a shift. These shall have been cleaned using a HEPA Filtered vacuum and wet cleaning methods. A container lined with a labeled 6-mil polyethylene bag for collection of disposable clothing shall be located in this room. Reusable footwear shall be stored in this area after being cleaned.

3.04 WASTE CONTAINER REMOVAL AIRLOCK AND EMERGENCY EXITS

A. The waste container pass-out airlock shall be constructed away from the Decontamination Enclosure System. This airlock shall be in a location that provides direct access from Abatement Work area to the outside of the building if possible.

B. This system shall consist of an airlock, container Staging Area, and another airlock providing access to outside Abatement Work area.

C. The waste container airlock shall be constructed in similar fashion with similar materials as the Decontamination Enclosure System.

D. This airlock system shall not be used to enter or exit the Abatement Work area.

3.05 ALTERNATIVE PROCEDURES

A. Soil Removal

1. Required Asbestos Abatement shall be performed prior to soil Removal.

2. If soil Removal is specified, debris within or upon the soil shall be considered part of the soil and shall be removed as a contaminated waste. Debris includes, but is not limited to, fabric, paper, and other fibrous or porous materials.

3. It is not the intention of this section to require the Removal of large rocks, abandoned non-Asbestos-containing pipe, lumber, and similar debris. If these conditions are encountered, clean and encapsulate these materials instead of removing them as a contaminated waste, provided Asbestos contamination is not ingrained within and/or affixed to them. Any such materials remaining shall be stacked to one side to allow for access to the soil below for removal purposes.

4. Unless otherwise specified, soil shall be removed with a High Volume Vacuum system. Soil shall be removed to the hard pan unless otherwise specified or required.

5. After soil Removal has been completed, the Owner Consultant shall inspect the Work. Approval of the Removal Work is required prior to lock down and Encapsulation.

6. Soil requires Encapsulation following Asbestos Removal, including but not limited to, High Volume Vacuum removal. Apply a continuous even coat of encapsulating material at the rate of no more than fifty square feet per gallon. Other structural surfaces shall receive an evenly applied coat of lock down material.

B. Other:

1. High Volume Vacuum systems shall be provided with an Enclosure constructed at the waste discharge port. This Enclosure shall be of sufficient size to accommodate the workers and disposal containers necessary for the Project. The Enclosure shall be constructed of one layer, 6-mil minimum, of polyethylene sheeting. An air filtration unit shall be furnished during operation of the High Volume Vacuum.

2. Where pipe insulation is to be removed in a crawl space and/or attic space a single layer of 6-mil polyethylene sheeting with a minimum width of four feet shall be placed centered under the Removal surfaces.

3. If specified procedures cannot be furnished, a written request shall be provided to the Owner outlining details of the problem encountered and recommended alternative solutions.

4. Alternative procedures shall provide equivalent or greater protection than the specified and/or required procedures.

5. Any alternative procedure requires the written approval of the Owner prior to implementation.

3.06 WORKPLACE ENTRY AND EXIT PROCEDURES

A. Before entering the Regulated Area personnel shall read and be familiar with posted regulations, personal protection requirements, and emergency procedures. A signature sheet shall be posted for signatory acknowledgement these have been reviewed and understood by personnel prior to entry.

B. Workers and other authorized personnel shall enter the Abatement Work area through the Decontamination Enclosure System or other room required when Decontamination Enclosure System is not required.

C. Personnel who enter or exit the Regulated Area shall sign the entry and exit log located adjacent to the Clean Room.

D. Personnel shall proceed first to the Clean Room, don respirator, and washable and/or disposable clothing.

E. General construction area equipment including, but not limited to, hard hats, eye protection, and gloves shall also be provided as required. Clean respirator and cartridges, and protective clothing shall be provided and utilized by each person for each separate entry into the Regulated Area.

F. Before leaving the Regulated Area for Class I and II asbestos work personnel shall remove gross contamination from the outside of respirators and protective clothing by vacuuming and/or wet wiping methods. Each person shall clean protective footwear just prior to entering the Equipment Room.

1. Personnel shall proceed to Equipment Room where they remove protective equipment except respirators. Deposit disposable clothing into appropriately labeled containers.

2. Still wearing respirator, personnel shall proceed to the shower area, clean the outside of the respirators and the exposed face area under running water prior to removal of respirator then shower and shampoo to remove residual Asbestos contamination. Various types of respirators will require slight modification of these procedures. A powered air purifying respirator face piece will have to be disconnected from the filter/power pack assembly when such is not waterproof, upon entering the shower. A dual cartridge respirator may be worn into the shower and cartridges shall be replaced for each new entry into the Work area.

3. After showering and drying off, proceed to the Clean Room and don clean clothing.

G. At no time shall any personnel exit an Abatement Work area into a space occupied by staff or students without being completely dressed. Any violation of this requirement will result in the permanent removal of the person from the Project site.

3.07 REMOVAL PROCEDURES

A. Brushes furnished for removing loose Asbestos Containing Material during detail cleaning of substrate shall be furnished with nylon or fiber bristles. Metal or wire brushes are not permitted.

Brushes used during this process shall be disposed as contaminated waste when use of the brush for this work is completed.

B. A sufficient supply of HEPA Filtered vacuum systems shall be provided during cleanup of Abatement Work. Brush attachments are not permitted for use with vacuum systems.

C. Barriers constructed to isolate the Regulated Area from other areas shall be inspected at least three times per shift; prior to the start of Abatement activities; half way into the shift; and following the completion of the Abatement activities at the end of the shift. Inspect and document observations in the daily Project log.

D. Damage and defects in the Enclosure system shall be repaired immediately upon discovery.

E. At any time during Abatement Work, following barrier installation, if visible debris is observed outside of the Regulated Area or damage occurs to the barriers, stop Work immediately. Repairs shall be performed to the barriers and debris/residue shall be cleaned up with appropriate HEPA Vacuuming and wet wiping methods. These incidents shall be recorded in the daily Project log.

F. If air samples collected outside of the Work area during Abatement Work indicate airborne fiber concentrations greater than 0.01 f/cc or the pre-measured background levels (whichever is lower) Work shall stop immediately. An inspection and repair of barriers shall be performed as required. Surface cleaning with HEPA Vacuums and wet wiping methods of areas outside of the Work area may be required by the Owner. Findings, observations, and corrective actions shall be documented in the daily Project log.

3.08 ENCAPSULATION AND BRIDGING AGENTS

A. Clean and isolate the Work area in accordance with "Work Area Preparation" of this Section.

B. Repair damaged and missing areas of existing materials with non-Asbestos containing substitutes. Material shall adhere adequately to existing surfaces and provide an adequate base for application of Encapsulating Material. Filler material shall be installed in accordance with manufacturers recommended specifications.

C. Remove loose or hanging Asbestos Containing Materials in accordance with the requirements of "Removal Procedures" in this Section.

D. Lockdown and Encapsulating Material, and bridging agents shall be reviewed by the Owner Consultant prior to the commencement of the Work of this section.

E. Encapsulating Material shall be sprayed applied with airless spray equipment. Nozzle pressure shall be adjustable within a range of 400 to 1500 PSI.

F. Lock down coat shall be spray applied with low pressure providing a continuous even coat.

G. Bridging agents shall be a palm or brush grade.

H. Colorless lock down materials, Encapsulating Material, and bridging agents shall be furnished with a compatible color additive. A different color shall be furnished for each separate coat of applied material.

I. Install penetrating type Encapsulating Material to penetrate existing sprayed applied Asbestos Containing Materials to a depth as required.

J. During installation of the penetrating type Encapsulating Material; remove selected random core samples of the Asbestos Containing Materials in the presence of the Owner Consultant to verify depth of penetration.

K. Lock down coating and Encapsulating Material for installation on hot water, steam, or any other high temperature equipment shall be manufactured and recommended for installation on high temperature systems.

3.09 CLEAN UP PROCEDURES

A. Asbestos Clean Up Procedures:

1. Unless decontaminated daily, reusable footwear and kneepads shall be stored in the Equipment Room when not in the Work area. Upon completion of Abatement Work, these shall be disposed of as Asbestos contaminated waste or may be decontaminated at the completion of Abatement Work.

2. Remove and containerize visible accumulations of Asbestos Containing Material and Asbestos contaminated debris with rubber dustpans and rubber squeegees. Do not use metal shovels to pick up or move accumulated waste. Special care shall be taken to minimize damage to flooring materials.

3. Remove containerized waste from the Abatement Work area and the waste container airlock.

4. Wet wipe surfaces in the Regulated Area with clean rags, mops, and sponges as appropriate.

5. After cleaning remove the top layer of polyethylene sheeting from walls and floors.

6. Clean the second layer of polyethylene sheeting by wet wipe and HEPA Vacuuming. Windows, doors, HVAC system vents, and other critical seals shall remain sealed until the Abatement Work area passes final clearance. The air filtration units shall remain in continuous operation and the Decontamination Enclosure System shall remain in place and be utilized.

7. Decontaminate tools and equipment and remove at the appropriate time in the cleaning process.

8. Provide notification to the Owner at least one day in advance when Abatement Work will be completed and ready for final visual inspection. If, upon inspection, Abatement Work is not completed or the area does not pass final visual inspection, finish or correct the Abatement Work as required before notifying the Owner. Subsequent inspections shall commence not later than one day following notice.

9. The Owner Consultant shall inspect the Work area for visible residue. If residue is observed, it shall be deemed to contain Asbestos and the cleaning process shall be repeated. The lock down coat shall be applied only after inspection by the Owner Consultant and during non-school hours.

10. The second layer of isolation shall only be removed after the Owner Consultant inspects the lock down coat or installed Encapsulation, but in no case prior to overnight drying of lock down coat or Encapsulation.

11. Following completion of air clearance monitoring the remaining barriers shall be removed and properly disposed of. A final visual inspection by the Owner Consultant shall be performed to verify that no contamination remains in the Abatement Work area. Unsatisfactory conditions may require additional cleaning and air monitoring.

3.10 WASTE HANDLING AND TRANSPORTATION

A. Asbestos Waste Handling

1. As the Work progresses, to prevent exceeding available storage capacity on the Project site, sealed and labeled containers of Asbestos Containing Waste shall be removed and transported to the prearranged disposal location.

2. Waste disposal shall occur at an authorized site in accordance with regulatory requirements of NESHAP and applicable State and Local regulations.

3. Once the drums, bags, and/or wrapped components have been removed from the Work area, they shall be loaded into an enclosed truck for transportation.

4. Waste shall not be transported from the work are to the storage container or waste hauler's vehicle while students or staff are present in the path of travel. Where a path of travel cannot be cordoned off the movement of waste must be completed prior to or after the presence on site of students and staff.

5. Personnel loading Asbestos waste shall be protected with disposable clothing and at a minimum half-face, air purifying, dual cartridge respirators furnished with HEPA Filters.

3.11 TRANSPORTATION OF NON HAZARDOUS WASTE

A. Waste shall be containerized, labeled, and transported in accordance with federal, state, and local regulations.

B. Waste shall be transported under cover a non-Hazardous Waste manifest.

C. Containers shall be enclosed during transportation.

3.12 TRANSPORTATION OF HAZARDOUS WASTE

A. Dump receipts; trip tickets, transportation manifests, weight certificates or other documentation of disposal shall be delivered to the Owner Consultant within 48 hours of disposal. As the material and responsibility for the material changes hands, the generator or designee, the transporter(s), and the Disposal Site Operator shall sign the Uniform Hazardous Waste Manifest. If a separate waste hauler is employed, the name, address, U.S.E.P.A. ID number, and signature of the transporter shall also be affixed onto the manifest.

B. The enclosed cargo area of trucks or containers shall be free of debris and lined with 6 mil polyethylene sheeting to prevent contamination from leaking or spilled containers. Floor sheeting

shall be installed first and extend up the sidewalls. Wall sheeting shall be overlapped and taped into place.

C. Drums shall be placed on level surfaces in the cargo area and packed tightly together to prevent shifting and tipping. Large structural components shall be secured to prevent shifting, with bags placed on top.

D. Access openings on large metal containers, which are used for storing or transporting Asbestos waste, shall have doors and tops that can be closed and locked. Materials not properly bagged shall not be placed in these containers nor shall these containers be used for non-Asbestos waste or nonhazardous asbestos waste. Bags shall be placed, not thrown, into these containers to avoid damage.

3.13 MONITORING

A. Abatement Project Management and Inspection:

1. Owner has the right to perform air and performance monitoring at any time.

2. The Owner has unlimited access to the regulated and surrounding areas at times during progress of the Work, including, but not limited to, use of ladders, scaffolds, and other equipment required to gain access to the Work surfaces.

B. Work Area Monitoring:

1. Visual inspections and air testing may be performed at any time during the progress of the Abatement Work. Provide corrective measures as required to maintain the Work area in compliance with this Specification and regulatory requirements.

C. Contractor's Employee – Personal Air Monitoring:

1. Provide air monitoring as required California Code of Regulations, Title 8, Section 1529. Results shall be provided to the Owner Consultant within ten working days of sampling. Negative Exposure Assessments utilizing prior project monitoring require submittal of applicable data for approval before work proceeds.

D. Clearance Air Monitoring:

1. Following the completion of Abatement Work and clean up operations, lock down coat application, and visual inspection by the Owner, clearance air monitoring shall be performed by the Owner Consultant.

2. The Owner Consultant shall arrange for sampling of the air in the Abatement Work area for airborne fiber concentrations. Unauthorized interference or tampering with air sampling equipment may result in termination of the Contract and/or removal of the Abatement Contractor from the List of Prequalified Abatement Contractors.

3. If air-sampling results are within the limits of 40 CFR, Part 763, Subpart E (AHERA), the Abatement Work area shall be released for occupancy.

4. Areas failing clearance monitoring shall be cleaned as required in article 3.09, CLEAN UP PROCEDURES, and tested until satisfactory levels are provided in accordance with this Specification where required.

3.14 RE-ESTABLISHMENT OF THE WORK AREA AND SYSTEMS

A. Reestablishment of the Work area shall only occur following the completion of final inspection and clearance air monitoring.

B. Critical barriers shall be removed at this time.

C. Accompanied by the Owner Consultant, visually inspect the Abatement Work area for any remaining visible residue. Evidence of contamination will require additional cleaning requirements.

D. Install and secure Moveable Objects.

E. Relocate Moveable Objects that were removed to temporary locations back to their original positions.

F. Reestablish HVAC, mechanical, and electrical systems to the condition prior to commencement of the Work of this section.

G. Repair areas of damage deemed to be a result of the Abatement Work.

H. Restore the Work area and auxiliary areas utilized during the Abatement to conditions equal to or better than original. Any damage caused during the performance of Abatement Work, including, but not limited to, damage caused by tape, adhesive, staples, nails, water, Encapsulating Material, or any other material shall be repaired as required.

I. Prior to occupancy of a space following clearance monitoring, HVAC systems filters associated with the Work area shall be removed and disposed of as Asbestos waste. Decontaminate filter assembly and surrounding area with HEPA Vacuums and wet cleaning methods.

END OF SECTION

SECTION 02 8219

ASBESTOS ABATEMENT OF NON-FRIABLE
ROOFING MATERIAL

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Abatement of building and structure related Asbestos.

2. Removal of building and structure related Asbestos.

3. Disturbance of building and structure related Asbestos.

4. Attachment A.

B. Regulatory Requirements shall include, but not be limited to:

1. U.S. Environmental Protection Agency Regulations for Asbestos (Title 40, Code of Federal Regulations, Part 61, Subpart M, and Part 763, Subpart E.)

2. Title 8, Article 4, California Code of Regulations Construction Industry Safety Orders, Section 1529 "Asbestos" or current revised California regulations.

3. South Coast Air Quality Management District (SCAQMD) Rule 1403.

1.02 SECTION DEFINITIONS AND ACRONYMS

A. Abatement – Procedures to control fiber release from Asbestos Containing Materials or Asbestos Containing Construction Materials. Includes Removal, Encapsulation, Enclosures, Repair, Demolition, and Renovation activities but does not include Asbestos Related Disturbance.

B. AHERA - Asbestos Hazard Emergency Response Act, 40 CFR, Part 763, Subpart E, and subsequent amendments.

C. Air Filtration and Ventilation System - A portable exhaust system, equipped with HEPA filtration, and capable of maintaining a constant air flow into a Regulated Area from adjacent areas and exhausted outside the Regulated Area.

D. Amended Water - Water to which a surfactant (wetting agent) has been added.

E. ANSI - American National Standards Institute.

F. Asbestos - Means the asbestiform varieties of chrysotile (Serpentine); crocidolite (Riebecktite); amosite (cummingtonitegrunerite); anthophyllite; tremolite; and actinolite.

G. Asbestos Containing Construction Material (ACCM) – Means any manufactured construction material which contains more than one tenth of one percent (0.1 percent) Asbestos by weight.

H. Asbestos Containing Material (ACM) – Means any material containing more than one-percent (1 percent) Asbestos.

I. Asbestos Containing Waste (Non-hazardous) – Non-Friable Asbestos Containing Material including, but not limited to, floor covering, roofing materials and cementitious materials requiring disposal.

J. Asbestos Containing Waste (Hazardous) – Friable Asbestos Containing Materials and Asbestos contaminated objects and debris requiring disposal.

K. Asbestos Related Disturbance – is the drilling, coring, removal or similar disturbance of ACCM or ACM not to exceed three square feet in any one opening and not to disturb 100 square feet or greater cumulatively on any one project (contract).

L. ASTM - American Society for Testing and Materials.

M. Building ID Number or Code - A six digit alphanumeric identification code assigned to each building on an Owner site, also referred to as the insurance code, ID number or similar terms.

N. Bulk Samples - Samples of building or other materials collected for analysis to determine the presence and quantities of Asbestos.

O. Class I, II, III, and IV asbestos work has the meaning as defined in California Code of Regulations Title 8, Section 1529.

P. Clean Room - An uncontaminated area or room, which is a part of the worker Decontamination Enclosure System with provisions for storage of worker's street clothes and clean protective equipment.

Q. Competent Person - Has the same meaning as defined in the California Code of Regulations Title 8, as it relates to, "Competent Person."

R. Controlled Disturbance – An activity by which a contractor disturbs an asbestos containing material or an asbestos containing construction material using the work practices allowed for in this specification and in compliance with regulatory limitations.

S. Curtained Doorway – A device to allow ingress and egress from one room to another while permitting minimal air movement between the rooms, typically constructed by placing two overlapping sheets of plastic over an existing or temporarily framed doorway, securing each along the top of the doorway, securing the vertical edge of one sheet along one vertical side of the doorway and securing the vertical edge of the other sheet along the opposite vertical side of the doorway. Other effective designs may be submitted for review.

T. Decontamination – The process of eliminating Asbestos contamination from building surfaces, objects, and property, by cloths, mops, or other utensils dampened with water and disposed of afterwards as Asbestos contaminated waste.

U. Decontamination Enclosure System – Means an enclosed area, which is adjacent and connected to the Regulated Area, consisting of an Equipment Room, Shower Room, and Clean Room for the Decontamination of workers, materials, and equipment contaminated with Asbestos.

V. Demolition - The wrecking or taking out of any load supporting structural member of a facility together with any related handling operations.

W. DOSH - Division of Occupational Safety & Health or Cal/OSHA.

X. DOT – Department of Transportation.

Y. DTSC – Department of Toxic Substances Control.

Z. Encapsulating Material - A liquid material applied to Asbestos Containing Materials which controls the possible release of Asbestos fibers from the material either by creating a membrane over the surface (bridging agent) or by penetrating into the material and binding its components together (penetrating Encapsulating Material).

AA. Encapsulation - The application of an Encapsulating Material to Asbestos Containing Materials to prevent the release of Asbestos fibers into the air.

BB. Enclosure - The construction or application of an airtight, impermeable, permanent barrier around Asbestos Containing Material to control the release of Asbestos fibers into the air.

CC. Equipment Room - A room within the worker Decontamination Enclosure System with provisions for storage of used clothing and equipment and for controlled transfer of materials and equipment into and out of the regulated area.

DD. Facility Component – Means any part of a facility including equipment.

EE. FETU – Facilities Environmental Technical Unit.

FF. Fixed Object - A piece of equipment, furniture, or improvement in the Work area, which cannot be removed from the Work area.

GG. Friable Asbestos - Asbestos Containing Material which, when dry, can be crumbled, pulverized or reduced to a powder by hand pressure or as defined by current regulations.

HH. Glove Bag Technique - A method with limited applications for removing small amounts of Asbestos Containing Material from short piping runs, valves, joints, elbows, and other non-planar surfaces in a Work area. The glove bag assembly is a manufactured or fabricated device consisting of a glove bag (typically constructed of 6 mil transparent polyethylene or polyvinyl chloride plastic), two inward projecting long sleeves gloves, an internal tool pouch, and labeled for Asbestos waste. The glove bag is constructed and installed in such a manner that it surrounds the object or material to be removed and contains all Asbestos fibers released during the process. All workers who are permitted to perform the Glove Bag Technique shall be thoroughly trained, experienced, and skilled in this method.

II. Hazardous Waste - Means Friable Asbestos generated and prepared for waste disposal. Does not include non-friable material or materials containing one-percent or less of Asbestos as determined by PLM and/or the point counting method.

JJ. HEPA Filter - Means a filtering system capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles 0.3 microns in diameter or larger. For respirators this shall include NIOSH rated P-100 cartridges only.

KK. HEPA Vacuum - A vacuum system furnished with HEPA filtration.

LL. High Volume Vacuum - A vacuum system with the capacity to collect material through a 4-inch diameter hose a minimum distance of 150 feet. This system shall be furnished with HEPA Filter at the air exhaust port and water applicators within the hopper.

MM. HVAC – Heating, Ventilation, and Air Conditioning System.

NN. Location Code - Refers to a unique four digit numeric code assigned by the Owner to each of its Project sites.

OO. Lockdown Coat – A material applied to surfaces where Asbestos has been completely removed. The manufacturer shall determine the concentration of this material.

PP. Member – A component part of a structure complete in itself.

QQ. Movable Object - A portable piece of equipment or furniture in the Work area, which can be removed from the Work area.

RR. NESHAP - National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61).

SS. NIOSH - National Institute for Occupational Safety and Health.

TT. Outside Air - Air outside of buildings and structures.

UU. Owner Consultant (OC) - Refers to the firm, company or individual designated by the Owner.

VV. PCM - Phase Contrast Microscopy as it relates to clearance air, personnel exposure assessment, and ambient air monitoring. This procedure must follow the NIOSH Method 7400, Asbestos Fibers by PCM.

WW. PLM - Polarized Light Microscopy used for bulk sample analysis with dispersion staining for the determination and quantifying of Asbestos in Bulk Samples building materials.

XX. Regulated Area - Designated rooms, spaces or areas of the Project in which asbestos Abatement actions are to be performed or which may become contaminated as a result of Abatement activities. A contained Work area is a Work area, which has been sealed and furnished with a Decontamination Enclosure System. A non-contained Work area is an isolated or controlled access Work area, which has not been sealed or furnished with a Decontamination Enclosure System.

YY. Removal – Means all operations where all ACM and/or PACM is removed or stripped from structures or substrates including Demolition.

ZZ. Renovation – Means the modifying of any existing structure, facility, or portion thereof.

AAA. SCAQMD – South Coast Air Quality Management District.

BBB. Shower Room - A room between the Clean Room and the Equipment Room in the worker Decontamination Enclosure System furnished with hot and cold running water controllable at the tap, and suitably arranged for complete showering during Decontamination.

CCC. Small Scale Short Duration – Such work not to exceed amounts greater than those which can be contained in a single glove bag or may not exceed amounts greater than those which can be contained in a single prefabricated mini-enclosure. Such an enclosure shall conform spatially and geometrically to the localized work area, in order to perform its intended containment function, and as completely defined in 40CFR, 763, Subpart E, Appendix C, Asbestos Model Accreditation Plan, section 8, a thru j.

DDD. Staging Area - Areas near the Waste Transfer Airlock where containerized Asbestos waste is temporarily placed prior to permanent removal from the Work area.

EEE. Surfactant - A chemical wetting agent added to water.

FFF. TEM - Transmission Electron Microscopy as defined for Asbestos clearance air monitoring within AHERA. This procedure must follow the NIOSH Method 7402, Asbestos Fibers by TEM.

GGG. TSI - Thermal System Insulation as defined in AHERA.

HHH. USEPA or EPA – United States Environmental Protection Agency.

III. Visible Emissions - Any emissions from a known or suspected Asbestos Containing Material that is visually discernible.

JJJ. Waste Transfer Airlock - A Decontamination system provided for transferring containerized waste from inside to outside of the Work area.

1.03 POLICIES AND PROCEDURES

A. The following requirements and procedures shall be a part of the contract in conformance with Rule 1403 of the South Coast Air Quality Management District and the California Division of Occupational Safety and Health (Cal/OSHA).

B. The asbestos-containing roofing materials located in areas identified in other portions of this contract have been tested and analyzed, and found to be a Class I non-friable asbestos-containing material under the provisions of Rule 1403.

C. The following requirements apply to the notification, certification, work area preparation, removal, transportation, cleanup, and disposal of non-friable asbestos-containing roofing materials. The language herein shall not be construed to conflict with, or supersede the requirements of Rule 1403 nor any other regulatory requirements in law.

1.04 ROLES AND RESPONSIBILITIES

A. Roles and Functions:

1. Coordinate the Work of this section directly with the Owner and/or Owner Consultant.

2. All Work under this section shall be performed in strict accordance with all applicable Federal, State, and Local regulations, standards, and codes governing asbestos Abatement and any other Work performed in conjunction with the Asbestos Abatement Work.

3. The most recent edition of any relevant regulation, standard, document, or code is in effect. Where conflict among the requirements or with this Specification exists, the most stringent requirement shall be provided.

1.05 NOTIFICATION

A. Contractor shall be responsible to notify the Division of Occupational Safety and Health and the SCAQMD and pay any related fees as required. A copy of these notifications shall be presented to the District prior to the start of work. The notice shall be posted at the job site. If the site involved in this contract is within the city limits of Los Angeles, a copy of the notification shall be sent to the Los Angeles City Fire Department (LAFD), marked courtesy copy. No fee to the LAFD is required for LAUSD projects.

1.06 LICENSING AND CERTIFICATION

A. All workers involved in the removal of non-friable asbestos-containing roofing materials shall receive training as an accredited asbestos worker, as required by AHERA (40CFR, part 763, subpart E), and posses a certification documenting this. The contractor shall provide proof that each worker has been trained as required by AHERA and Cal/OSHA requirements. A current certificate documenting asbestos worker or contractor/supervisor accreditation from an EPA approved training facility shall be considered proof within itself.

B. Each work location shall have one individual assigned as the lead person. The lead person/competent person shall be designated by name, be on site at all times during the setup, removal, and cleanup and shall have a certificate documenting contractor/supervisor accreditation from an EPA approved course. This individual shall be responsible to ensure all regulation, procedures and contractual requirements pertaining to asbestos-containing material removal are strictly adhered to while performing the project.

C. The contractor shall be certified by the State Contractors Licensing Board and registered with the State Division of Occupational Safety and Health for the removal of asbestos-containing materials. If the removal of the asbestos-containing material is to be sub-contracted, the prime contractor and the sub-contractor shall be certified by the State Contractors Licensing Board but only the sub-contractor is required to be registered with the State Division of Occupational Safety and Health.

1.07 PERSONAL PROTECTION

A. All persons in the work area shall be required to wear, at a minimum, disposable protective clothing and respiratory protection sufficient to protect workers from the determined concentration of asbestos in the work area as required by Title 8 of the California Code of Regulations, but never less than a half-face negative pressure respirator with dual HEPA filtered cartridges.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. The following products have been specifically approved for use as encapsulants/lock-down or bridging agents for Owner asbestos abatement and asbestos related construction projects and lead abatement and lead abatement related construction projects. Products not approved by the Owner shall not be used.

1. Asbestos Removal Encapsulant Foster 32-60 blue by Foster Products Corporation; removal, lock down or penetrating with dilution.

2. ABC Asbestos Binding Compound 6421, 6422 and 6423 by Fiberlock Technologies, Inc.; general use, removal, lock down, penetrating and bridging; this product is good for soils.

PART 3 - EXECUTION

3.01 ABATEMENT PROCEDURES AND WORK AREA PREPARATION

A. Work Area Preparation:

1. Remove all non-stationary objects from the work area and store in an area that is not subject to contamination by subsequent roofing removal.

2. Cover all stationary objects and surfaces not intended for removal or stripping of asbestos-containing materials. Cover and render air-tight, with minimum 6-mil polyethylene sheeting, all air passageways such as door, windows, and vents that are immediately adjacent or contiguous to the work area surface. (This does not include openings at the sides or ends of the building and therefore not immediately adjacent to the roof).

3. It is the responsibility of the contractor to ensure that all windows of the building remain closed and locked during the removal procedures.

B. Removal and Handling:

3. No tools that would promote debris becoming airborne, such as brooms, blowers, and high-pressure rinse, etc. shall be used.

4. Using amended water, applied with an airless sprayer at a low pressure setting or low pressure spray equipment, adequately wet the material prior to processing and throughout the work period so as to ensure the material remains wet until final disposal.

5. Removal shall be done with manual tools limiting material breakage to a minimum. Small sections shall be removed and handled to limit incidental dispersion of waste from off of the removal surface. Cutting may be performed by nonabrasive methods, such as shearing equipment or tools.

6. Bituminous roofing materials may be cut with a knife into smaller hand-manageable pieces.

7. Roofing materials shall not be dropped, slid (unless inside a chute), or thrown to the ground. If material falls to the area below, it shall be picked up and the area cleaned immediately.

C. Cleaning:

1. After passing a visual inspection of the work area the contractor shall remove all isolation installed during the area preparation.

D. Transportation and Disposal:

1. For off-loading from heights greater than fifty (50) feet above the storage container, a leak-tight enclosed chute shall be used to convey materials to the container.

2. For heights less than 50 feet, the debris shall carefully lowered to the disposal container below.

3. After removal of all roofing materials, all remaining debris shall be placed in the waste container.

4. All plastic sheeting used to protect or isolate the work site shall be placed in the waste container.

5. This material shall be disposed of at a landfill that will accept Class I non-friable asbestos-containing waste. Before waste is removed from the District site, the contractor shall notify the District of the landfill to be used, indicating the name and address. Comply with all requirements and regulations enforced or imposed by the landfill in the course of disposing waste generated from a District site.

6. It is the responsibility of the contractor to ascertain and comply with the requirements of the Department of Transportation and other regulatory agencies as it pertains to transporting and disposing of non-friable asbestos-containing waste to a landfill.

7. The contractor shall provide and complete the NON-hazardous waste manifest for transporting this waste.

3.02 GENERAL

A. For the purposes of this contract, amended water is water with the addition of a surfactant, or wetting agent, that provides a surface tension of 29 dynes/cm as tested using ASTM method D1331, Standard Test Methods for Surface and Interfacial Tension of Solutions of Surface-Active Agents.

B. Certificates documenting AHERA accreditation for all workers shall be provided to the District prior to the start of any work. Any worker arriving on site for the purpose of working on setup, removal, or cleanup of the roof removal portion of the project must provide a copy of their training certificate. Any worker arriving without a certificate will be denied access to work on the project until a current certificate is provided.

C. Copies of the State Contractors' License Board certification and Division of Occupational Safety and Health registration shall be provided to the District prior to the start of the project and be posted at the job site.

3.03 PROTECTION OF ATTIC SPACES FROM CONTAMINATION:

A. Attics below roofs to be abated that are identified in the scope of work as free of asbestos contamination are to be protected from contamination from asbestos-containing roofing material during the abatement process.

B. During the course of the abatement of asbestos-containing roofing material, if debris is generated into the attic space resulting in contamination the contractor shall clean and de-contaminate the attic space. Clearance air monitoring will be required following such cleaning and de-

contaminating. The cost for the clearance air monitoring and analysis will be the responsibility of the contractor as well.

END OF SECTION

SECTION 02 8333

LEAD ABATEMENT AND LEAD RELATED CONSTRUCTION WORK

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Abatement, Lead Related Construction Work or painting of lead-containing materials and/or Lead Based Paint.

2. Transportation and disposal of lead-containing materials and/or Lead Based Paint.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Cal/OSHA Title 8, California Code of Regulations (CCR).

3. California Air Resources Board Ambient Air Quality Standard, Title 24 CCR.

4. California Department of Public Health, Title 17, CCR.

5. Cal/EPA, Title 22 CCR.

6. California Labor Code, Division 5, Part 1, as it pertains to safety in employment and with the applicable provisions of the Title 8, CCR as it pertains to Occupational Safety and Health in the work place.

7. Environmental Protection Agency, 40CFR, Part 745.

8. UD – Title X, Residential Lead-Based Paint Hazard Reduction Act of 1992.

9. Los Angeles County Public Health Code (Chapter 11).

1.02 DEFINITIONS AND ACRONYMS

A. AAS - Atomic Absorption Spectrophotometry used for lead paint chip and dust wipe sample analysis.

B. Abatement – Any set of measures designed to reduce or eliminate lead hazards or Lead Based Paint for public and residential buildings, but does not include containment or cleaning.

C. Action Level – Means the Action Level as defined in Title 8, California Code of Regulations, Section 1532.1.

D. ANSI – American National Standards Institute.

E. ASTM – American Society for Testing and Materials.

F. Building ID number or code (Maximo) – A six digit alphanumeric identification code assigned to each building on an Owner site, also referred to as the insurance code, ID number or similar terms.

G. Certificate – Means the document issued by CDPH to an individual meeting the certification requirements as described in CCR Title 17, Sections 35083, 35085, 35087, 35089, or 35091.

H. Clean Room – An uncontaminated area or room which is a part of the worker Decontamination Enclosure System with provisions for storage of worker's street clothes and clean protective equipment.

I. Clearance Inspection – Means visual examination and, as applicable, collection of environmental samples upon completion of the Work of this section.

J. Component – Means a structural element or fixture, including but not limited to, walls, floors, ceilings, doors, window molding, trim, trestles, tanks, stairs, railings, cabinets, gutters, or downspouts.

K. Curtained doorway – A device to allow ingress and egress from one room to another while permitting minimal air movement between the rooms, typically constructed by placing two overlapping sheets of plastic over an exiting or temporarily framed doorway, securing each along the top of the doorway, securing the vertical edge of one sheet along one vertical side of the doorway and securing the vertical edge of the other sheet along the opposite vertical side of the doorway. Other effective designs may be submitted for review.

L. Decontamination – The process of eliminating lead contamination from building surfaces, and property by cloths, mops, or other utensils dampened with water and disposed of as lead contaminated waste.

M. Decontamination Enclosure System – A minimum a two-stage Decontamination unit consisting of a compartment for Decontamination, and a Clean Room. Unless otherwise specified, it shall be adjacent to the Abatement area.

N. Demolition – The wrecking or taking out of any load supporting structural member of a facility together with any related handling operations.

O. Deteriorated Lead Based Paint – Means Lead Based Paint or a surface coating that is cracking, chalking, flaking, chipping, peeling, non-intact, failed, or otherwise separating from the substrate to which it is applied to.

P. CDPH– California Department of Public Health.

Q. CDPH-Approved Course – Means any lead construction course that satisfies the requirements specified in CCR Title 17, Sections 35056, 35061, 35066, or 35067 as determined by CDPH pursuant to Sections 35076 and 35078.

R. DOSH – California Division of Occupational Safety & Health or Cal/OSHA.

S. DOT – Department of Transportation.

T. DTSC – California Department of Toxic Substances Control.

U. Encapsulating Material – Are coatings or rigid materials adhesively applied to Lead Based Painted surfaces in the Encapsulation process.

V. Encapsulation – The application of an Encapsulating Material to Lead Based Paint to provide a barrier between the Lead Based Paint and the environment.

W. Enclosure – A rigid durable barrier mechanically attached to building Component, with edges and seams sealed with caulk or other sealant.

X. EPA; Renovation, Repair and Painting (RRP) – Means a lead-related construction course that satisfies the requirements specified in 40 CFR, Part 745, Section 745.90.

Y. FETU – Facilities Environmental Technical Unit.

Z. Firm – Means a company, partnership, corporation, sole proprietorship or individual doing business, association, or other business entity; a Federal, State, Tribal, or local government agency; or a nonprofit organization and satisfies the requirements specified in 40 CFR, Part 745, Section 745.89.

AA. Fixed Object – A piece of equipment, furniture, or improvement in the Work Area, which cannot be removed from the Work Area.

BB. Hazardous Waste – Means any waste stream determined by an Owner approved laboratory to exceed the regulatory thresholds for lead hazardous waste.

CC. HEPA Filter – Means a filtering system capable of trapping and retaining at least 99.97 percent of mono-dispersed particles 0.3 micrometers in diameter or larger.

DD. HEPA Vacuum – A vacuum system furnished with HEPA filtration.

EE. HUD – United States Department of Housing and Urban Development

FF. HVAC – Heating, Ventilation, and Air Conditioning system.

GG. ICP-AES – Means Inductively Coupled Plasma-Atomic Emission Spectroscopy used for heavy metal analysis, including lead.

HH. Lead Based Paint – Means paint or other surface coatings that contain an amount of lead equal to or greater than 0.7 milligrams per square centimeter (0.7 mg/cm^2) or equal to or greater than 0.5 percent by weight.

II. Lead Containing Paint – Means paint or other surface coatings that contain lead in an amount equal to or greater than 0.06 percent lead dry weight (600 ppm) but does not meet the definition of Lead Based Paint. In the absence of paint chip or surface coating bulk sample results, any surface coating shall be assumed to be above 0.06 percent lead dry weight (600 ppm) until surface coating samples are collected and analyzed that indicate otherwise. Lead concentration shall be determined by a method that has an accuracy of not less than plus or minus 25 percent at 0.06 percent lead dry weight, to a confidence level of 95 percent.

JJ. Lead Contaminated Dust – Means dust that contains an amount of lead equal to, or greater than, forty micrograms per square foot (40 μg/ft^2) for interior floor surfaces; two hundred and fifty micrograms per square foot (250 μg/ft^2) for interior horizontal window surfaces; and eight hundred micrograms per square foot (800 μg/ft^2) for exterior floor and exterior horizontal window surfaces.

KK. Lead Contaminated Soil – Means bare soil that contains an amount of lead equal to, or greater than, four hundred parts per million (400ppm).

LL. Lead Hazard – Means deteriorated Lead Based Paint, Lead Contaminated Dust, Lead Contaminated Soil, the disturbance of Lead Based Paint or Presumed Lead Based Paint without containment, or any other operation that may result in persistent and quantifiable lead exposure.

MM. Lead Inspection – Means a surface by surface investigation to determine the presence of Lead Based Paint as described in Chapter 7: Lead Based Paint Inspection, " Guidelines for the Evaluation and Control of Lead Based Paint Hazards in Housing," U.S. Department of Housing and Urban Development, 1997 Revision.

NN. Lead Related Construction Work – Means any construction, alteration, painting, Demolition, salvage, Renovation, repair, or maintenance of any residential or public building, including preparation and cleanup that, by using or disturbing lead-containing material or soil, may result in significant exposure of adults or children to lead.

OO. Lead Safe Schools Program – Means the training program for lead safe working practices as developed by the Labor Occupational Health Program at U.C. Berkley.

PP. Location Code (Maximo) – Refers to a unique four digit numeric code assigned by the Owner to each of its Project sites.

QQ. Member – A Component part of a structure complete in itself.

RR. Movable Object – A piece of portable equipment or furniture in the Work Area, which can be removed from the Work Area.

SS. NESHAP – The National Emission Standards for Hazardous Air Pollutants (40 CFR Part 50.12).

TT. NIOSH – The National Institute for Occupational Safety and Health.

UU. Owner Consultant (OC) – Refers to the firm, company or individual designated by the Owner.

VV. Painting Contract – For purposes of this section, a painting contract is a Contract with the Owner to perform painting on existing facilities where Lead Based Paint, Lead Containing Paint, Presumed Lead Based or Presumed Lead Containing Paint will be disturbed or abated.

WW. P.E.L. – Means permissible exposure limits as defined in Title 8, California Code of Regulations, Section 1532.1.

XX. Plasticize – To cover floors, walls, and equipment with plastic sheeting as specified herein.

YY. Portable Mechanical Ventilation System – A portable exhaust system furnished with HEPA filtration and capable of providing a constant air flow into regulated Work Area from adjacent areas and exhausted outside the regulated area.

ZZ. Presumed Lead Based Paint – Means paint or surface coating affixed to a Component in or on a structure, excluding paint or surface coating affixed to a Component in or on a residential dwelling constructed on or after January 1, 1979, or a school constructed on or after January 1, 1993.

AAA. Removal – Means operations where Lead Based Paint is removed or stripped from structures or substrates including Demolition.

BBB. Renovation – Means the modifying of any existing structure, facility, or portion thereof.

CCC. Replacement – Means Removal of an entire building Component coated with Lead Based Paint and replacing it with a lead free Component.

DDD. SCAQMD – South Coast Air Quality Management District.

EEE. STLC – Means Soluble Threshold Limit Concentration used in the State of California in conjunction with TTLC to determine lead hazardous waste limits. If the STLC result is equal to or exceeds 5 mg/L the waste is deemed to be hazardous.

FFF. Surfactant - A chemical wetting agent added to water.

GGG. TCLP – Means Toxicity Characteristic Leaching Procedure used to determine the federal Resources Conservation Recovery Act (RCRA) lead hazardous waste limits. If the results equal or exceed 5 mg/L the waste is deemed to be hazardous.

HHH. TTLC – Means Total Threshold Limit Concentration used in the State of California in conjunction with STLC to determine lead hazardous waste limits. If the results are equal to or exceeds 1000 mg/kg, the waste is deemed to be hazardous.

III. Visible Emissions – Any emissions from a known or suspected lead-containing material that is visually discernible.

JJJ. Wet Cleaning – The process of eliminating lead contamination from building surfaces and/or objects by cloths, mops, or other utensils dampened with amended water and afterwards being disposed of as hazardous waste.

KKK. Work Area – Means an area where known or Presumed Lead Based Paint is disturbed or Abatement is conducted.

LLL. X-Ray Fluorescense (XRF) Analyzer – Means a direct reading instrument that determines the lead content of the surface coatings in milligrams per square centimeter (mg/cm^2) using the principle of x-ray fluorescence.

1.03 POLICIES AND PROCEDURES

A. The Owner has a zero-tolerance policy for uncontrolled lead releases during Lead Related Construction Work, Lead Containing Paint disturbance, or Abatement activities. A lead release requiring an emergency response is any disturbance resulting in the uncontrolled release of lead containing materials. Upon observation of any visual emissions, immediately stop the Work, vacate the Work Area, and provide written notification to the Owner Consultant.

B. Pre-qualified Abatement Subcontractors are not permitted to subcontract any Abatement Work to a lower tier Subcontractor without the prior written approval of the Owner.

C. Do not furnish a reduced pressurization and filtration system in violation of, or in infringement upon, any patent.

D. Owner Consultant shall provide oversight for Projects that have the potential to disturb lead containing or Lead Based Paint. Prior to the commencement of such Work, provide written notification to the Owner Consultant.

E. The following paragraph regarding impacts to coated surfaces shall be part of the contract:

1. “Renovation, repair or painting work performed on buildings constructed prior to 1978 require special handling and environmental monitoring when coated surfaces including, but not limited to, painted, varnished, and glazed surfaces are impacted. Coated surfaces applied prior to 1978 are assumed to be lead-based. All work shall be performed in compliance with Specification, Section 02 8333, “Lead Abatement and Lead Related Construction Work.” XRF testing methodology is not acceptable in determining negative for lead content for Cal/OSHA compliance purposes, except for notification requirements. XRF may be used in determining lead-based paint for compliance with the U.S.E.P.A. Renovator, Repair, and Painting Rule. Disturbance of coated surfaces by contractors will be monitored by qualified District staff or Environmental Consultant sufficient to ensure that proper training and work procedures, cleanup, and waste handling are employed.”

1.04 COORDINATION

A. Coordinate the Work of this section directly with the Owner and/or Owner Consultant.

1.05 SITE SECURITY

A. The Work Area is restricted to authorized, trained, and protected personnel. A list of authorized personnel shall be established and posted at the entrance of the Work Area by the Owner Consultant prior to commencement of the Work.

B. Report to the Owner Consultant any unauthorized entry into the Work Area. Following notification, a written report of the incident shall be provided to the Owner Consultant.

C. A logbook shall be maintained at the entrance of the Work Area. Persons entering the Work Area shall record name, company affiliation, time in, and time out for each entry and exit.

D. Access to the Abatement Work Area shall be through the Decontamination Enclosure System only. Other means of access shall be blocked or locked so as to prevent entry to or exit from the Work Area. Emergency exits shall be operable from inside the Work Area.

E. Maintain Work Area security during Abatement and/or Lead Related Construction Work. Work Areas and ancillary equipment accessible to non-authorized personnel shall be protected from unauthorized access by constructing a minimum barrier of 3/8 inch CDX plywood supported by 2 by 4 studs, 16 inches on center. An access door shall be provided with hasp and padlock sufficient to prevent unauthorized entry. A key shall be provided to the Owner and Owner Consultant. Required barriers within an occupied building shall be furnished with sheathing as required by state and local fire protection regulations.

F. Remove barriers upon the completion of the Work of this section and unless otherwise specified, repair and/or replace to its original condition, damage resulting from installation, use, and removal of the barriers.

1.06 EMERGENCY PLANNING

A. Emergency planning and procedures shall be developed, submitted, reviewed, and agreed to by the Owner Consultant prior to the commencement of lead-related construction and/or Abatement Work.

B. Emergency procedures shall be provided in the written languages understood by employees working on the Project and shall be prominently posted at the entrance of the Decontamination Enclosure System. Prior to entering the Work Area, parties must read and sign these procedures to acknowledge receipt and understanding of the Work Area layout, location of emergency exits, and emergency procedures.

C. Emergency planning shall consider the effects of fire, explosion, toxic atmospheres, electrical hazards, slips, trips and falls, confined spaces, and heat related injury. Develop and provide written procedures and training to employees.

D. Employees shall be trained in evacuation procedures in the event of workplace emergencies.

E. In the event of non-life threatening situations requiring medical treatment, injured or otherwise incapacitated employees shall decontaminate following normal procedures with assistance from fellow workers if necessary, before exiting the Work Area.

F. In the event of life threatening injury or illness requiring immediate medical treatment, worker Decontamination shall be given minimum priority. Provide measures to stabilize the injured worker remove them from the Work Area and secure proper medical treatment.

G. Telephone numbers of emergency response personnel shall be prominently posted at the entrance of the Decontamination Enclosure System along with the location of the nearest telephone. In addition to the 911 emergency number, post the address and telephone number of the nearest emergency medical services provider.

H. Provide at least one employee on the Project site at times during progress of the Work that is trained and certified in first aid and cardiopulmonary resuscitation (CPR). This employee shall be identified by name and proof of training shall be provided to the Owner Consultant prior to the commencement of the Work of this section.

I. Provide at least one 4A/60BC dry chemical extinguisher in the Decontamination compartment. Workers shall be trained in the proper operation of fire extinguishers.

J. Emergency exits shall be provided and clearly marked with arrows or other clearly visible markings to permit easy identification from anywhere within the Work Area. Exits shall be secured to prevent access from uncontaminated areas while still permitting emergency egress. Exits shall be properly sealed with polyethylene sheeting, which can be cut to permit emergency egress. Emergency exits may lead through the Decontamination Enclosure System or other alternative exits as required by fire officials.

1.07 LICENSING

A. The Work of this section shall be performed by an entity duly licensed in the State of California in accordance with the provisions of Chapter 9 of Division 3 of the Business and Professions Code, as amended.

1.08 QUALIFICATIONS

A. Only safety pre-qualified bidders on the pre-approved bidders list are qualified to be awarded an Abatement Contract or Painting Contract be listed as a Subcontractor for lead Abatement Work or Painting Contract.

B. Where the scope of the Work includes the painting and/or refinishing of existing surfaces, only safety pre-qualified bidders on the pre-approved bidders list are qualified to be awarded a painting Contract or be listed as a Subcontractor for painting Work.

C. Before any workers perform Abatement Work or Work of this section where the P.E.L. is exceeded, submit proof of CDPH training and certification. No Work shall be performed until the Owner Consultant has reviewed and approved CDPH training and certifications.

D. Workers shall be in personal possession of a wallet CDPH certification card at times while they are performing Abatement Work on the Project site.

E. Workers performing lead Abatement, Lead Related Construction Work, or disturbance of Lead Containing Paint where the exposure level exceeds the P.E.L., shall possess current CDPH certification and at least one CDPH Certified supervisor shall be available as required by Title 17, CCR subsection 36100.

1.09 TRAINING

A. Lead Related Construction Work shall be performed by personnel with the following training, as applicable:

1. The Lead Related Construction Work, specified herein, shall be performed by individuals trained and qualified in the techniques of lead-related construction, handling, disposal of lead-based and Lead Containing Paint, and the subsequent cleaning of contaminated areas. These individuals must comply with the applicable Environmental Protection Agency (EPA), Renovation, Repair and Painting (RRP) programs lead-related construction course that satisfies the requirements specified in 40 CFR, Part 745, Section 745., and must be capable of and willing to perform the Work of this section.

2. The Lead Related Construction Work, specified herein, shall be performed by a company, partnership, corporation, sole proprietorship or individual doing business, association, or other business entity; a Federal, State, Tribal, or local government agency; or a nonprofit organization, shall satisfy the requirements specified in 40 CFR, Part 745, Section 745.89, as a Lead-Safe Certified Firm.

3. Lead Abatement Work, specified herein, shall be performed by individuals trained and qualified in the techniques of lead abatement and will receive CDPH accredited training and certification, and must be capable of and willing to perform the Work of this section.

2. Training specific to the performance of Lead Related Construction Work shall be provided to employees prior to performing the Work of this section.

3. Training specific to the operation and use of fire extinguishers.

1.10 EXPOSURE ASSESSMENT

A. Disturbance of Lead Containing Paint, as defined in this Specification, disturbed by tasks not included in Title 8, CCR Section 1532.1, Subsection (d)(2), shall require worker-exposure monitoring upon initiation of the Work. The workers performing these tasks shall be trained in accordance with the Hazard Communications Standard, Section 5194, including but not limited to, the requirements concerning warning signs and labels, Safety Data Sheets (SDS), and employee information and training.

B. Provide an exposure assessment where the workers are performing Lead Related Construction Work. If historical data, collected within the 12 months prior to the Work performed, indicates worker exposure is below the P.E.L. , and the Work being performed closely resembles the process, type of material, control methods, work practices, and environmental conditions, additional exposure assessment is not required.

C. For Lead Related Construction Work where there is objective data or an exposure assessment demonstrating that the Lead Based Paint, or a specific process, operation or activity other than Abatement involving lead cannot result in employee exposure to lead at or above the P.E.L. during the specific process or handling, employees trained as required by Title 8, CCR Section 1532.1, including the training topics of the Lead-Safe Schools Program, may perform the Lead Related Construction Work.

D. Where Work being performed indicates an exposure above the Action Level, each employee is required to have current blood lead level and Zinc Protoporphorin testing, medical clearance for negative pressure respirator use, and respirator fit testing.

E. If there is no objective data or a negative exposure assessment fulfilling the above requirements, Lead Related Construction Work identified as a trigger task by Title 8, CCR 1532.1 shall be performed by workers who have received training as required by Title 8 CCR, Section 1532.1. This training shall, at a minimum, include the training topics of the Lead Safe Schools Program. An exposure assessment is required to be performed upon initiation of Work.

F. The required exposure assessment shall not exceed 12 months from the date the samples were collected to the date the Lead Related Construction Work or disturbance of Lead Containing Paint is performed.

G. The submission and review by the Owner Consultant of the objective data or exposure assessment is required prior to performing Lead Related Construction Work.

1.11 SUBMITTALS

A. Provide in accordance with Division 01 and this section.

B. Prior to performing the Work of this section, submit the following procedures to the Owner Consultant:

1. An abatement plan including, but not limited to:

   a. A detailed written description of the measures and management procedures, including the containment that will be utilized during Abatement to prevent exposure to lead hazards. Shop Drawings shall indicate the containment locations.

   b. A detailed written description of the Abatement, including methods of Abatement, locations of rooms and building Component where Abatement is planned.

2. Required air monitoring procedures (Cal/OSHA mandatory and SCAQMD permits for air filtering equipment).

3. Decontamination procedures for personnel, Work Area, and equipment.

4. Procedures for handling and disposing of waste materials, including disposal facility.

5. Provide the procedures to be used for capturing debris while disturbing overhead materials.

6. Procedures for final Decontamination and cleanup.

7. Procedures for dealing with heat stress during Abatement.

8. Emergency procedures during Abatement.

C. Prior to performing Abatement Work of this section, submit the following Shop Drawings to the Owner Consultant:

1. Preparation of Work Area.

2. Layout and construction of Decontamination Enclosure System and barriers for isolation of the Work Area described in this Specification and required by applicable regulations.

D. Prior to performing the Work of this section, submit the following Product Data to the Owner Consultant:

1. Product Data relative to personal protective equipment including respiratory protection and protective clothing.

2. Material safety data sheets and technical specifications for proposed materials.

E. Prior to performing the Work of this section, submit the following notifications to the Owner Consultant:

1. Evidence of notification to Cal/OSHA as required by Title 8 CCR, Section 1532.1, where applicable.

2. Notify CDPHno less than five days in advance of Abatement by submitting an Abatement of Lead Hazard Notification, CDPHForm 8551.

F. Prior to performing the Work of this section, submit the following documentation to the Owner Consultant:

1. A list of employees who will participate in the Project, including delineation of experience, training, and assigned responsibilities during the Project.

2. Submit proof satisfactory to the Owner Consultant that required permits, site location, and arrangements for transport and disposal of lead containing waste has been performed in accordance with Federal, State, and local regulations.

3. Submit proof of training for each worker who will perform Abatement or Lead Related Construction Work.

4. Submit manufacturer’s certification that HEPA Vacuums, air filtration units and other local exhaust ventilation equipment conform to ANSI Z9.2, as applicable.

5. When HEPA Vacuums are utilized on the Project, provide the maintenance and filter change log for these before they are brought onto the Project site.

6. Provide the current SCAQMD permit for each HEPA Vacuum and Portable Mechanical Ventilation System before they are brought onto the Project site.

7. Where biological monitoring is required, submit test result documentation verifying employees have completed blood lead level and Zinc Protoporphorin tests in accordance with Title 8 CCR, Section 1532.1.

8. Workers are required to submit a signed Code of Conduct form.

G. Prior to performing the Work of this section, submit the following Samples to the Owner Consultant:

1. Submit a Sample of forms to be used in documenting the Work of this section.

H. Prior to performing the Work of this section, submit the following schedule to the Owner Consultant:

1. An intended sequence of Work and construction schedule. Coordinate both the sequence and durations with the Owner.

I. Prior to performing the Work of this section, submit other required items to the Owner Consultant.

J. During the performance of the Work of this section, submit the following documentation to the Owner Consultant:

1. Submit documentation from a physician certifying that employees who wear a negative pressure respirator are medically cleared to do so without suffering adverse health effects as required by DOSH regulations. The certification shall state that the employee or agent may perform Lead Related Construction Work and wear a negative pressure respirator without restrictions. Provide information to the examining physician about unusual conditions in the workplace environment that may impact the employee's ability to perform Work activities.

2. During the performance of the Work of this section, and before additional supervisors or workers are permitted to perform the Work of this section, submit proof of CDPHtraining and certification, where applicable. No additional supervisors or workers are permitted upon the Project site until the Owner Consultant has approved the CDPHtraining and certifications, when required.

3. Submit weekly job progress reports detailing Abatement and Lead Related Construction Work activities for Projects that will exceed thirty days. Include review of progress with respect to previously established Milestones and schedules, major problems and action taken, injury reports, equipment breakdown, and air and/or wipe sampling results.

4. Within five workdays of transport and disposal, submit copies of transport manifests, disposal receipts, analytical data, and weight certificates for hazardous waste removed

from the Work Area during the Lead Related Construction Work and/or Abatement Work. Weight certificates shall indicate by pounds the net weight of waste disposed of from the Project site as indicated on the associated manifest.

5. Submit daily, copies of Abatement Work site entry logbooks with information on worker and visitor access.

6. Submit logs on a weekly basis documenting filter changes on respirators, HEPA vacuums, HEPA filtered ventilation units, water filtration units, and other approved engineering controls, as applicable.

7. Submit results of air and/or wipe sampling data (as applicable) collected during the course of the Abatement and Lead Related Construction Work including DOSH compliance air monitoring results.

K. During the performance of the Work of this section, submit other required items.

1.12 PRE-ABATEMENT MEETING

A. Attend a meeting to be held prior to the commencement of the Work of this section. Attending this meeting shall be representatives of the Owner, the Owner Consultant if applicable, and the testing and monitoring personnel who shall actually participate in the testing and monitoring program. Secure the attendance of the individual who will be the Project site competent person for the Abatement Work.

B. At this meeting provide required submittals except for those to be submitted during progress of the Work. In addition, provide detailed information concerning:

1. Preparation of Work Area and Shop Drawings.

2. Personal protective equipment, including respiratory protection and protective clothing.

3. Employees who will participate in the Project, including delineation of experience, training, and assigned responsibilities during the Work.

4. Decontamination procedures for personnel, Work Area, and equipment.

5. Abatement methods and procedures to be provided.

6. Required air monitoring procedures (pre-Abatement, Cal/OSHA mandatory, and SCAQMD requirement).

7. Procedures for handling and disposing of waste materials, including disposal facility.

8. Procedures for final Decontamination and cleanup.

9. A sequence of Work activities and performance schedule.

10. Procedures for dealing with heat stress.

11. Emergency procedures.

PART 2 – PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Products: The following products have been specifically approved for use ass encapsulants/lock-down or bridging agents for Owner asbestos abatement and asbestos related construction projects and lead abatement and lead abatement related construction projects. Products not approved by the Owner shall not be used.

1. L-B-C Lead Barrier Compound 5400 be Fiberlock Technologies, Inc.; coating encapsulant.

B. Materials:

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

2. Store materials, subject to damage off the ground, away from wet or damp surfaces, and under cover sufficient enough to prevent damage or contamination. Replacement materials shall be stored outside of the Work Area until area is cleared for normal occupancy.

3. Damaged, deteriorating, or previously used materials shall not be furnished and shall be removed from the Project site and legally disposed of.

4. A sufficient supply of disposable mops, rags, and sponges for Work Area Decontamination shall be provided.

5. Unless otherwise specified, the Owner will provide water for construction purposes. Connect to existing system as required.

6. Products brought onto the Project site shall be accompanied by their respective Material Safety Data Sheet, which shall be maintained on the Project site.

7. Plastic, polyethylene sheeting or visqueen shall be a fire retardant type. Provide documentation from the manufacturer verifying compliance with this requirement.

8. Polyethylene sheeting furnished for the Decontamination Enclosure System shall be opaque white or black in color and shall be a minimum of 6-mil thick.

9. Surfactant (wetting agent) shall be a material that, when tested, demonstrates a surface tension of 29 dynes/cm as tested in its properly mixed concentration, using ASTM method D1331-56-"Surface and Interfacial Tension of Solutions of Surface Active

Agents." Where Work Area temperature may cause freezing of the Amended Water solution, the addition of approved antifreeze in a manufacturer recommended amount is permitted.

B. Equipment:

1. Disposal bags shall be of 6-mil polyethylene, pre-printed with labels as required by applicable Cal/OSHA and DOT requirements.

2. Provide labels as per DOT requirements for disposal containers.

3. Provide warning signs as required by Cal/OSHA.

4. Disposal containers shall meet requirements of Title 22, CCR.

5. Provide a sufficient supply of scaffolds, ladders, lifts, and hand tools, as needed to complete the Work.

6. Provide sprayers with pumps capable of providing amended water in sufficient quantity to adequately wet the material to be abated or for Lead Related Construction Work.

7. Provide a sufficient supply of HEPA filtered vacuums to maintain a clean environment in compliance with this section.

8. When an enclosure requiring negative pressure is specified, a sufficient quantity of air-filtration ventilation units furnished with HEPA filtration and operated in accordance with ANSI Z9.2and EPA guidance documents shall be utilized to provide one workplace air change every 15 minutes and creating a pressure differential of -0.02 inches of water everywhere within the enclosure when compared to the area outside the enclosure. A log documenting the filter change history of each unit shall be required before use, and any unit without this log shall have filters changed and the unit decontaminated.

9. When rental equipment is to be used in Abatement areas or to transport lead contaminated waste, a written notification concerning the intended use of the rental equipment shall be provided to the rental agency with a copy submitted to the Owner.

10. When performing chemical Removal, provide portable eyewash station(s) that meet ANSI standards and are accessible to workers within 10 seconds.

11. Additional safety equipment, as necessary, shall be provided to workers and authorized visitors.

12. Equipment delivered to the Project site shall be free of debris suspect of containing lead. No equipment with suspect debris in or on it shall be permitted on Owner properties and/or the Project site.

13. When roll-off disposal containers are delivered to a Project site, four wheels of each container shall be moved and rested upon a minimum size sheet of plywood of 4-foot by 4-foot by ¾ inch.

14. Lighting shall be provided in an amount sufficient to illuminate the Work Area for the purpose of safe visual working conditions and to permit examination of surfaces where Work is performed.

2.02 EMPLOYEE PERSONAL PROTECTIVE EQUIPMENT

A. Respiratory Protection:

1. Submit NIOSH approvals for respiratory protective devices utilized on the Project site. Include manufacturer certification of HEPA filtration capabilities for cartridges and filters. Filter cartridges shall be furnished with the NIOSH P-100 designation.

2. Provide respiratory protection to employees in compliance with CCR Title 8, Sections 1532.1 and 5144, as determined by the employee exposure assessment.

3. In the absence of an exposure assessment, base respiratory protection on the requirements of Title 8, CCR Section 1532.1, specifically subsection (d).

4. In addition to P-100 filters, provide the appropriate respirator filter cartridges for exposure to other airborne contaminants generated during the Abatement process.

5. Provide authorized visitors with a respirator and cartridges sufficient to protect individuals from exposure to hazardous environments generated during the Abatement activity.

B. Fit Testing:

1. Perform fit testing in accordance with Title 8 CCR, Section 5144.

2. Submit documentation of respirator fit testing for individuals entering the Work Area.

3. Maintain and submit to the Owner a copy of the written respiratory protection program.

C. Personal Protective Clothing and Equipment:

1. Provide eye protection to employees sufficient to protect employees from debris during work progress when full-face respirators are not being utilized.

2. Provide and require the use of eye protection when employees are working with a material that may splash or fragment, as specified by the Material Safety Data Sheet for a given product, or as required by Title 8, CCR.

3. Spectacle kits and eyeglasses must be provided for employees who wear glasses and who must wear full-face piece respirators. Provide respirators that have been tested and approved by the National Institute of Occupational Safety and Health for use in lead-contaminated atmospheres.

4. Provide full-body disposable protective clothing, including head, body, and foot coverings to workers and authorized visitors who enter the Work Area, in sizes adequate to

accommodate movement without tearing. A new suit shall be provided and donned for each separate entry.

5. If washable clothing is to be worn underneath disposable protective clothing, it shall be provided to Abatement workers.

6. Provide a clean staging area for workers and others to store street clothes and personal protective equipment.

7. Disposal suits shall be collected in an appropriate disposal container at the entrance of the Abatement Work Area.

8. Abatement workers are required to wear nonskid footwear sufficient to protect them from workplace hazards. Disposable clothing shall be adequately sealed to the footwear to prevent body contamination.

9. Hand protection shall be provided, and workers shall be required to use lotion sufficient quantities to protect the worker when chemicals or other physical hazards exist.

10. As required by the Work site and applicable safety regulations, provide head protection and require the use thereof.

11. Worker protection equipment shall be ANSI approved.

PART 3 - EXECUTION

3.01 LEAD RELATED CONSTRUCTION WORK

A. Work Area Preparation and Work Practices:

1. Where exposure monitoring indicates Worker exposure is below the P.E.L., comply with the requirements of this section and the “Monitoring” section of this Specification.

2. Disturbance of lead containing materials shall be performed using wet methods.

3. Work requiring overhead disturbances shall require a means of capturing debris, thus preventing an uncontrolled release on the worker or the surfaces below.

4. For disturbances utilizing local exhaust dust collection devices the equipment shall be designed and furnished with a HEPA filtered vacuum attachment approved by the manufacturer.

5. Where Components are to be removed, loose Lead Based Paint and Lead Containing Paint shall be removed by manual means using wet methods.

6. Where a Component is attached and painted onto another surface and the Component is to be removed from the adjoining surface the paint shall be cut with a razor knife to reduce the potential of paint chip debris during Component removal.

7. If a Component being removed will be disposed of rather than reinstalled, manually cut the Component into manageable sections for disposal using wet methods or mechanically cut using a manufactured approved HEPA filtered local exhaust dust collector.

8. If a Component is to be reused, loose paint or rough edges may require scraping or sanding. Scraping or sanding must be performed manually using wet methods or mechanically with a manufactured approved HEPA filtered local exhaust attachment.

9. For solid core surfaces where penetration or welding are required the lead containing material shall be removed from the area impacted using wet methods. Layers of Paint shall be removed before impact to the surface commences.

B. Clean Up Procedures:

1. During the entire process of Lead Related Construction Work, clean debris generated using wet methods and/or HEPA Vacuuming.

2. At the completion of the Lead Related Construction Work, clean surfaces within the impacted Work Area.

3. When HEPA filtered Vacuums are utilized, vacuum from the area of impact to the outer perimeter of the polyethylene sheeting to remove visible debris. If vacuuming cannot remove visible debris, wet wiping will also be required.

4. When wet wiping the Work Area, wipe from the area of impact to the outer perimeter of the polyethylene sheeting to remove visible debris.

5. Tools and equipment utilized in the Work Area shall be wet wiped to remove visible debris.

3.02 ABATEMENT

A. Work Area Preparation:

1. Clean areas to be isolated by HEPA Vacuum prior to installation of polyethylene sheeting.

2. Seal the Work Area with a layer of 6 mil thick polyethylene sheeting prior to any Lead Based or Lead Containing Paint Removal or disturbance by covering vents, windows, door openings, and any non-Moveable Objects such as lockers, etcetera.

3. Install a minimum of two layers of 6 mil thick polyethylene sheets on floors, fastened by waterproof tape and other means as necessary to secure the sheeting.

4. The covering on windows, exterior doors, and vents shall be installed from the outside to facilitate Work on them from the inside.

B. Decontamination Enclosure System:

1. At a minimum a two-stage Decontamination Enclosure System consisting of a compartment for Decontamination and a Clean Room shall be constructed and used.

2. Unless otherwise specified, the Decontamination Enclosure System shall be adjacent to the Abatement area.

3. Other enclosure methods may be used if submitted and approved by the Owner Consultant.

C. Removal and Replacement Substrates with Lead Based Paint:

1. Except as noted in the Specifications and Drawings, replace substrate with material of the same or better quality. Substrates include, but are not limited to doors, windows, moldings, casements, mantels, trims, skirting, baseboards, and associated hardware and fasteners.

2. Areas adjacent to substrate removal shall be protected from damage. Damages shall be repaired or replaced to original condition.

3. Substrates that are removed for replacement shall be wrapped and stored for disposal. Disposal shall be in accordance with the applicable codes and sections of this Specification.

4. After removal, the areas disturbed shall be cleaned and a Clearance Inspection performed in accordance with the procedures described in this Specification.

D. Abrasive Removers – Machine Sanders:

1. Machine sanders shall be furnished with a HEPA Vacuum system approved by the manufacturer.

2. Sanding shall only be performed on flat surfaces that allow the HEPA Vacuum dust collection attachment to come into tight contact with the surface being sanded.

3. Remove Lead Based Paint down to the bare substrate surface. If the pigment cannot be removed without damaging the substrate, submit a Request for Clarification to the Owner Consultant.

4. Protect adjacent surfaces from damage from machine sanding. Repair and/or replace damaged surfaces.

E. Chemical Removal-On-Site Chemical Removal:

1. No chemical Removal shall be performed on interior surfaces unless specifically called for and designed in the Specifications or the Abatement plan of the Project.

2. Owner approved chemical removers shall be compatible with and harmless to the substrate. On masonry surfaces chemical removers shall contain anti-stain formulation that inhibits discoloration.

3. Chemical Removal Agent Neutralizer: Use chemical Removal agent neutralizers on exterior surfaces only. Neutralizers shall be compatible with and not harmful to the substrate. Neutralizers shall be compatible with the Removal agent that has been applied to the surface substrate.

4. Apply chemical Removal agents and neutralizers in accordance with the recommendations of the manufacturer and the following:

   a. Adhere to health and safety regulations and other Specification section requirements. Stripping agents shall not be allowed to penetrate wood or other fibrous substrates.

   b. Remove the softened paint by scraping or wire brushing.

   c. Protect adjacent areas from damage from Removal agent during the course of Work.

F. Chemical Removal – Off-Site Chemical Removal – Structures of Historical Significance Only:

1. Remove and transport Lead Based Painted Component in accordance with this Specification. Transport the Component to an off-site location. Remove Lead Based Paint by chemical Removal. Neutralize and clean the Component. Return Component to the Project site free of lead-containing materials and reinstall.

2. Take extreme care in removing component to be taken off-site, to prevent damage. In addition:

   a. Component shall be marked and identified using an inconspicuous engraving, to insure reinstallation in original location.

   b. Hardware associated with a component shall be bagged and marked.

   c. If required, hardware shall be chemically stripped, cleaned, or reconditioned.

   d. Dispose of hazardous waste generated by the off-site stripping of Lead Based Paint as required by federal, state, and local regulations.

   e. Do not transport hazardous waste to Owner properties and/or facilities.

   f. Protect the component and the adjacent areas from which component are removed from damage by the removal and reinstallation procedures.

G. Water Jet Washing:

1. The purpose of the Water Jet Washing process is to remove Lead-Based and Lead Containing Paint from exterior masonry substrate.

2. If this procedure is selected, submit a Work plan to the Owner Consultant which includes, but is not limited to, interim controls, paint stabilization, and capture of waste water.

H. Encapsulation – Interior and Exterior - Coated Sealer System:

1. Materials: - Elastic acrylic coating shall be heavy bodied and warranted by the manufacturer to be compatible with the substrate. Elastic acrylic coating shall be long lasting and resist cracking, peeling, algae, and fungus.

2. Submittal: - Submit two Samples, 5 ½-inch by 8-inch of the encapsulation material to the Owner Consultant.

3. Encapsulation coatings shall be applied in accordance with the manufacturer's recommendations and the following conditions:

a. Remove surface dust and debris by scrubbing with a non-residue detergent solution, and rinsing. Remove loose paint until a sound, intact edge is achieved. Remove and replace loose plaster prior to the coating application. Proper safety procedures and lead dust control method in this Specification must be utilized.

b. Apply Encapsulation coatings to the substrate in a continuous coat to seal the surface being coated. The number of coats required and coverage rates shall be in accordance with the manufacturer's recommendations.

c. Repair materials that lift and peel after the application of the Encapsulation coating by scraping until a sound surface is obtained. The edges shall be feathered, and a reapplication of an Encapsulation coating shall be applied.

d. Remove, or cover as directed, existing fixtures located on surface to be coated, including but not limited to, electrical receptacles, switches, exhaust fans, and hardware.

e. Protect adjacent surfaces and existing fixtures from damage by coating system. Damages to adjacent surfaces and existing fixtures due to lack of protection or improperly applied protection shall be repaired and/or replaced.

I. Encapsulation – Interior and Exterior - Flexible Wall Covering:

1. Materials: Wall covering shall be a reinforced fiber type that forms a secure bond with the substrate, resistant to peeling and formation of mold. The wall covering system shall form a seal over the substrate to which it is applied and not allow the passage of substrate dust into the environment.

2. Submittal: Prior to the start of Work, submit to the Owner Consultant for approval, manufacturer's descriptive literature, and two 5 ½-inch by 8-inch Samples of each wall covering system.

3. Install Encapsulation covering in accordance with manufacturer's installation instructions and the following provisions:

   a. Remove foreign material by washing surfaces with a detergent solution. Remove loose plaster, loose paint, and loose wallpaper. Utilize dust control methods described in this Specification.

   b. Repair larger damaged areas flush with surrounding wall surfaces prior to installation of wall covering system.

J. Enclosure Procedures - Gypsum Wallboard (interior surfaces only), plywood paneling, other enclosures of exterior substrate:

1. Surface preparation: Remove foreign material by wash-down with a non-residue detergent solution. Remove loose plaster, loose paint, and loose wallpaper in accordance with this Specification to stabilize the painted surfaces.

2. Affix warning labels stating surface contains "LEAD-BASED PAINT" to the surface prior to being enclosed. Labels shall be 3-inch by 5-inch and placed four feet apart at approximately five foot high on the surface being enclosed.

3. Install selected enclosure material in accordance with the relevant section of the Specification. Any disturbance to Lead Based Paint in the execution of this section shall comply with the Lead Related Construction Work section of this Specification.

K. Soil Abatement:

1. Surface Contamination:

   a. Remove Lead Contaminated Soil from the locations and to a depth specified in the scope of Work.

   b. In the absence of a specified depth of soil removal identified in the scope of Work, submit, prior to the bid, a Request for Clarification regarding the quantity of soil to be removed.

   c. Submit a written soil abatement plan prior to initiation of the Project.

   d. No soil abatement shall proceed until the Work plan has written approval by the Owner Consultant.

   e. Refer to the waste handling and transportation section of this Specification for the handling, characterization, and disposal of waste.

L. Alternate Procedures:

1. If specified procedures cannot be utilized, a request must be made in writing to the Owner Consultant establishing details of the problem encountered and recommended alternatives.

2. Alternate procedures shall provide equivalent or greater protection than procedures that they replace.

3. Prior to implementation, alternative procedures shall be submitted and approved in writing by the Owner Consultant.

M. Clean Up Procedures

1. During the entire process of the Work of this section, perform continuous cleaning of debris generated using wet methods and/or HEPA filtered vacuuming.

2. At the completion of the Work of this section, clean surfaces within the impacted Work Area, including but not limited to, tools, equipment, and polyethylene sheeting to remove visible debris from the Work Area.

3. Tools and equipment utilized in the Work Area shall be thoroughly cleaned. Non-electrical tools and equipment shall be cleaned monthly and before Removal from the Work Area by HEPA vacuuming and washing using a lead specific detergent or other suitable cleaning agent.

4. Electrical tools and equipment shall be HEPA vacuumed and cleaned by wet wiping limiting the amount of water used to avoid electrical hazards.

5. Remove polyethylene sheeting, except for critical barriers, by folding it into itself beginning with the higher level polyethylene first.

6. Following Removal of polyethylene sheeting a final cleaning of surfaces in the Abatement workspace shall be performed by HEPA vacuuming, wet wiping, and a final HEPA vacuuming.

7. When HEPA vacuums are utilized, vacuuming shall be performed from the top down and from the area of impact to the outer edge of the polyethylene sheeting.

8. Apply no less than one continuous coat of approved paint or primer to abated surfaces, where applicable.

9. At the completion of the final clean up, the CDPHcertified supervisor shall inspect the Work Area for visible debris. If debris is identified, repeat the final cleaning process.

10. Wet wiping, washing, and cleaning required by this section shall include the Removal of visible debris by cleaning with a lead specific detergent or other suitable cleaning agent in clean water followed by a rinsing with clean water and clean rags, following the same sequence of cleaning as the vacuuming.

11. Refer to the waste handling and transportation section of this Specification for disposal of waste generated by this process.

3.03 WASTE HANDLING AND TRANSPORTATION

A. Characterization of Waste:

1. Until analytical results are available, waste materials (including water containing paint chips) shall be treated as hazardous. Visible paint chips shall be separated from waste water before characterization. Following removal of solids the waste water shall be characterized to determine disposal requirements. The paint chips removed from the waste water may be disposed of as assumed RCRA hazardous waste or characterized to determine disposal requirements.

2. Characterize waste streams as follows:

a. Collect a representative sample of the waste material.

b. For a pile of waste take one sample of a proportionate combination of Component in the pile. If a large quantity of waste is generated no less than four samples may be required.

c. For large wood Component, such as windows, doors, etcetera, a representative sample of each Component of similar characteristics, paint history, etcetera, shall be collected and tested. A full depth core sample, not less than one inch diameter, of the Component is to be collected. The core sample shall include the substrate and paint coatings on both sides of the Component, as applicable.

3. Analysis for the waste characterization samples shall be performed as follows:

a. Waste generated by chemical stripping shall, in addition to the requirements for determining the solid and soluble lead concentrations, shall be tested for corrosiveness and other contaminants, as applicable, resulting from the chemical stripping process.

b. Analyze samples for Total Threshold Limit Concentration (TTLC):

1) If results are less than 50 mg/kg (milligrams/kilogram) the waste is not hazardous and shall be disposed as general construction waste.

2) If sample results are 50 mg/kg or greater, the waste shall be tested for Soluble Threshold Limit Concentration (STLC).

c. Where waste is required to be tested for STLC the following shall apply:

1) If the STLC result is less than 5 mg/L (milligrams/liter) the material shall be disposed at a Class II waste landfill. Evidence of such results of the

STLC testing will be required by the landfill before waste is accepted. No further testing is required.

2) If the STLC results are 5 mg/L or greater, the waste is a California regulated waste and the material shall be tested using the federally mandated Toxicity Characterization Leaching Procedure (TCLP).

d. Where waste is required to be tested by TCLP the following shall apply:

1) If the TCLP is less than 5 mg/L, the waste is a California regulated hazardous solid waste (non-RCRA). This material shall be disposed in a Class I hazardous waste landfill.

2) If the TCLP is equal to or greater than 5 mg/L, the waste is a federally regulated hazardous waste solid (RCRA). The waste shall then be disposed in a Class I hazardous waste landfill.

e. Personal and commercial wash water with lead contamination shall be handled as follows:

1) Filter the waste water through cheesecloth, or other similar filtering media, to remove the gross debris. Separate the waste streams and characterize these in compliance with this Specification.

2) If the waste water is identified as a RCRA or California regulated hazardous waste (Non-RCRA) by STLC and TCLP, filter the waste water by power pumping it through a 20 micron pore size filter. The filtered water shall be tested as described for waste in this Specification.

3) If test results categorize the filtered water as non-hazardous, it may be disposed of in the sewer system.

4) Wastewater, filtered or otherwise, shall not be discharged in storm drains, gutters or allowed to sheet flow over the surface of the ground.

B. Waste Handling:

1. Waste, hazardous and non-hazardous, shall be disposed of at an authorized site in accordance with provisions of this Specification and applicable Federal, State, and local laws.

2. Any waste determined to be hazardous, through analytical testing, shall be kept in a secured area or lockable container that is inaccessible to persons other than authorized personnel working on the Project. Hazardous waste containers shall be labeled “Hazardous-Waste – Contains Lead” and labeled with the date waste collection commenced.

3. Hazardous waste shall not remain on the Project site beyond 90 days of the date it was generated. It shall be removed from the Project site and transported to an approved landfill before the 90 days has elapsed.

4. Waste shall not be transported from the work are to the storage container or waste hauler's vehicle while students or staff are present in the path of travel. Where a path of travel cannot be cordoned off the transportation of waste must be completed prior to of after students and staff are not on site.

5. Once hazardous waste is removed from the Project site, ensure it is disposed of in an approved landfill within 6 days. The waste shall not be transported to another site for commingling of waste from a source other than the site of original generation. This requirement shall be documented by the proper execution of a Uniform Hazardous Waste Manifest signed by the landfill operator.

6. Hazardous and non-hazardous waste shall be kept in different containers and stored in separate locations. Commingling of waste is not permitted.

7. As the Work progresses, to prevent exceeding available storage capacity on the Project site, sealed and labeled containers of lead waste shall be removed and transported to the prearranged disposal location.

8. Containers used for hazardous waste shall meet the requirements of EPA and DOT for hazardous waste storage and transport. At a minimum, disposal packaging of Lead Based Paint fragments, dust, and debris shall be in 6-mil polyethylene (plastic) bags that are airtight and puncture resistant.

9. Any debris or residue observed on containers or surfaces outside of the Work Area resulting from clean up or disposal activities shall immediately be cleaned using HEPA filtered vacuum equipment and/or wet methods as appropriate.

10. Materials not contained in bags or other appropriate disposal containers shall not be placed in lead waste storage containers, nor shall storage containers be used for non-lead waste. To avoid damage, packaged waste shall be placed, not thrown, into the storage containers.

11. Lead Contaminated Soil shall be transported in plastic lined containers.

C. Transportation of Non-Hazardous Waste:

1. Receipts from the disposal facility, trip tickets, transportation manifests, weight certificates or other documentation of disposal shall be delivered to the Owner Consultant within 48 hours of disposal. The waste manifest shall be signed by the generator, the transporter(s), and the disposal site operator each time the responsibility for the waste material is transferred. If a separate hauler is employed, the name, address, and signature of the transporter shall also appear on the manifest.

D. Transportation of Hazardous Waste:

1. Hazardous waste shall be transported by a RCRA/DOT/EPA certified hazardous waste transporter. Provide evidence that the hazardous waste transporter meets the requirements of this Specification.

2. The Work of this section includes responsibility for actions of the hazardous waste transporter as it pertains to waste Removal and disposal related to the Work of this Specification.

3. Identify the facility to which the waste generated by this Specification will be taken. Evidence shall be provided verifying the facility is licensed/permitted to receive and handle non-hazardous lead containing waste and/or hazardous lead containing waste as applicable.

4. Waste disposed as hazardous shall be transported under a Uniform Hazardous Waste Manifest. The generator copy of this manifest shall be submitted to the Owner Consultant within five days of transport.

5. Dump receipts, trip tickets, transportation manifests, weight certificates or other documentation of disposal shall be delivered to the Owner Consultant within 48 hours of disposal. The Uniform Hazardous Waste Manifest shall be signed by the generator (or designee), the transporter(s), and the disposal site operator each time the responsibility for the waste material is transferred. If a separate hauler is employed, the name, address, U.S.E.P.A. ID number and signature of the transporter shall also appear on the manifest.

6. The enclosed cargo area of trucks or containers shall be free of debris and lined with 6-mil polyethylene sheeting to prevent contamination from leaking or spilled containers. Floor sheeting shall be installed first and extend up the walls. Wall sheeting shall be overlapped and taped into place.

7. During transport, drums and other containers shall be placed on level surfaces in the cargo area and packed tightly together to prevent shifting and tipping. Large structural Component shall be secured to prevent shifting and bags placed on top.

3.04 MONITORING

A. Project Management and Inspection:

1. Owner has the right to perform air, wipe, and visual monitoring at any time.

2. Owner shall proceed in accordance with the terms and conditions of the Contract Documents whenever the Work or protective measures are not in compliance with applicable governmental regulations, Contract requirements, and/or threatens the adjoining environment with lead contamination.

3. Where exposure monitoring indicates exposure is at or above the P.E.L. comply with Title 8, CCR Section 1532.1 (e) through (n).

B. Employee – Personal Air Monitoring:

1. Provide air monitoring as required by Title 8 CCR, Section 1532.1. Results shall be provided within ten working days of sampling. If the intent is to utilize such as exposure assessment documentation, and Work is to commence earlier than ten working days, submit results 24 hours in advance of the start of Work.

C. Clearance Inspection:

1. Clearance Inspection for Lead Related Construction Work shall include:

a. A visual inspection of the Work Area by the Owner Consultant prior to occupancy for normal activity.

b. Do not remove barriers designating a regulated Work Area until a written release from the Owner Consultant is provided.

c. The Owner Consultant has the right to collect wipe samples as part of the Clearance Inspection.

2. Clearance Inspection for Abatement shall include:

a. A visual inspection of the Work Area by the Owner Consultant prior to collection of environmental samples (dust, wipe, and/or soil samples, as applicable).

b. Owner Consultant shall collect environmental samples.

c. Results of samples shall comply with Title 17, CCR before the Work Area is released for normal occupancy.

d. Where samples fail to meet regulated clearance levels of Title 17, CCR, clean the Work Area as required for final cleaning in the Clean Up Procedures section of this Specification.

e. Following cleaning, the visual inspection and environmental sampling will be repeated as described above. This process shall continue until the clearance level of Title 17, CCR is provided.

3.05 RE-ESTABLISHMENT OF THE WORK AREA AND SYSTEMS

A. Re-establishment of the Work Area shall only occur following the completion of clean-up procedures and after a Clearance Inspection has been performed and documented to the satisfaction of the Owner Consultant.

B. Re-secure Moveable Objects removed from their former positions during area preparation activities.

C. Relocate Moveable Objects that were removed to temporary locations back to their original positions.

D. Reestablish HVAC, mechanical and electrical systems to the condition prior to commencement of the Project.

E. Repair areas of damage that occurred as a result of Abatement or Lead Related Construction Work.

3.06 PROJECT COMPLETION DOCUMENTATION

A. Provide to the Owner Consultant of the following close-out documentation:

1. Filter change logs for air filtration units, water filtration units and respirators
2. Foreman's daily job reports
3. Employee entry and exit logs for Work Areas
4. Visitor entry and exit logs for Work Area
5. Air sample results for personnel
6. Copies of hazardous and non-hazardous waste manifest
7. Hazardous waste weight tickets
8. Analytical data and chain of custody for waste characterization
9. Signed Daily Personnel Report Forms

B. Provide Owner Consultant with as-built drawings identifying surfaces where Lead Based Paint has been encapsulated or enclosed.

END OF SECTION

SECTION 03 01 30

Maintenance of Cast-In-Place Concrete

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, general provisions of the Contract, and other related construction documents such as Division 01 specifications apply to this Section

1.2 SUMMARY

A. This Section includes a self-drying, cement-based finish underlayment that provides a smooth surface prior to the installation of floor covering over a variety of substrates, including concrete with relative humidity up to 95%.

1. ARDEX FEATHER FINISH® XF™ Self-Drying, Cement-Based Finish Underlayment

2. ARDEX P 82™ Ultra Prime

3. ARDEX P 51™ Primer

B. Related Sections include the following:

1. Section 03 30 00, Cast-In-Place Concrete

1.3 REFERENCES

A. ASTM F2170, Relative Humidity in Concrete Floor Slabs Using in situ Probes

B. ASTM F710, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data, a Revit file with applicable materials meeting the Revit Content Style Guide, and installation instructions for each material and product used. Include manufacturer’s Safety Data Sheets.

B. Qualification Data: For Installer

1.5 QUALITY ASSURANCE

A. Installation of the ARDEX product must be completed by a factory-trained applicator, such as an ARDEX LevelMaster® Elite, Choice Contractor or INSTALL Substrate Prep Certified Installer, using mixing equipment and tools approved by the manufacturer. Please contact ARDEX Engineered Cements (724) 203-5000 for a list of recommended installers.

B. Product must be cement-based having an inorganic binder content which includes a minimum 80% Portland cement per ASTM C150: Standard Specification for Portland cement and other specialty hydraulic cements. Gypsum products are not acceptable.

C. Manufacturer Experience: Provide products of this section by companies which have successfully specialized in production of this type of work for not less than 5 years. Contact Manufacturer Representative prior to installation.

1.6 WARRANTY: ARDEX FEATHER FINISH® installed as part of a floor system, shall be installed in conjunction with the recommended ARDEX Tile & Stone Installation Materials or WW HENRY Flooring Adhesive, as appropriate, to provide the ARDEX SystemOne comprehensive warranty, depending on the system installed.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver products in original packaging, labeled with product identification, manufacturer, batch number and shelf life.

B. Store products in a dry area with temperature maintained between 50° and 85°F (10° and 29°C and protect from direct sunlight.

C. Handle products in accordance with manufacturer's printed recommendations.

1.8 PROJECT CONDITIONS

A. Do not install material below 50°F (10°C) surface and air temperatures. These temperatures must also be maintained during and for 48 hours after the installation of products included in this section. Install quickly if substrate is warm and follow warm weather instructions available from the ARDEX Technical Service Department.

PART 2 - PRODUCTS

2.1 MAINTENANCE OF CAST-IN-PLACE CONCRETE

A. Self-Drying, Cement-Based Finish Underlayment

1. Acceptable Products:

a. ARDEX FEATHER FINISH® XF™; Manufactured by ARDEX Americas Aliquippa, PA, USA 724-203-5000, www.ardexamericas.com

i. Primer
1. Other non-porous substrates, such as epoxy coating systems, metal substrates and concrete treated with silicate compounds: ARDEX P 82™ Ultra Prime
2. Gypsum: ARDEX P 51™ Primer

2.2 WATER: Water shall be clean, potable, and sufficiently cool (not warmer than 70°F).

PART 3 – EXECUTION

3.1 PREPARATION

A. General: Prepare substrate in accordance with manufacturer's instructions.

1. Concrete:

a. Prior to proceeding please refer to ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring. All concrete subfloors must be sound, solid, clean, and free of all oil, grease, dirt, curing compounds and any substance that might act as a bond breaker before priming. Mechanically clean if necessary using shot blasting or other. Acid etching and the use of sweeping compounds and solvents are not acceptable.

b. Substrates shall be inspected in accordance with ASTM F2170 and corrected for moisture or any other conditions that could affect the performance of the underlayment or the finished floor covering. For areas where moisture vapor emissions exceed the required limits refer to Section 09 05 61.13, Moisture Vapor Emission Control and install the appropriate ARDEX Moisture Control System.

2. Crack and Joint Preparation

   a. Moving Joints and Moving Cracks – honor all moving joints and moving cracks up through the installation. A flexible sealing compound such as ARDEX ARDISEAL™ Rapid Plus Semi-Rigid Joint Sealant may be installed.

   b. Dormant Control Joints and Dormant Cracks – Fill all dormant control joints and dormant cracks with ARDEX ARDIFIX™ Low Viscosity Rigid Polyurethane Crack & Joint Repair or ARDEX FEATHER FINISH® as recommended by the manufacturer.

3. Gypsum: All gypsum subfloors must be thoroughly clean and free of dirt, debris, sealers and contaminants that might act as a bond breaker. Mechanically clean if necessary using shot blasting or other. Please be advised, however, that the fact remains that the substrate is gypsum, and therefore has inherent weakness. ARDEX FEATHER FINISH will provide a solid surface to which new flooring can bond, but cannot change the fact that a weak substrate lies below.

4. Wood:

   a. The wood subfloor must be constructed according to prevailing building codes and must be solid and securely fixed to provide a rigid base free of undue flex. Any boards exhibiting movement must be re-nailed. The surface of the wood must be clean and free of oil, grease, was, dirt, varnish, shellac and any contaminant that might act as a bond breaker. If necessary, sand down to bare wood. A commercial drum sander can be used to sand large areas. Do not use solvents, strippers or cleaners. Vacuum all dust and debris. It is the responsibility of the installation contractor to verify that the wood subfloor is thoroughly clean and properly anchored.

   b. Some flooring manufacturers recommend a finish-grade wood underlayment be installed over the existing wood subfloor. If necessary, ARDEX FEATHER FINISH can be used to smooth fasteners and/or joints in the wood underlayment. Please note that the wood underlayment must be suitable for the installation of the specific floor covering and must be installed in accordance with the wood underlayment manufacturer's recommendations.

5. Metal: Metal substrates must be rigid, well supported, properly anchored, and free of undue flex and vibration. They must also be clean, including the complete mechanical removal of rust, corrosion and any contaminant that may act as a bond breaker. It is the responsibility of the installation contractor to ensure that this is so. To prevent, rust from recurring, steel surfaces must be coated with an anticorrosive epoxy coating and allowed to dry thoroughly. The coating must be installed in strict accordance with the coating manufacturer’s written recommendations and allowed to cure fully. Lead, copper and aluminum do not need to be coated with an anticorrosive epoxy.

6. Adhesive residues on concrete must first be tested to make certain they are not water-soluble. Water-soluble adhesives must be completely mechanically removed down to clean

concrete. Non-water-soluble adhesives should be prepared to a thin, well-bonded residue using the wet-scraping technique as recommended by the Resilient Floor Covering Institute (www.rfci.com). The prepared residue should appear as nothing more than a transparent stain on the concrete after scraping.

7. Other Non-Porous Substrates: The substrate must be clean, including complete removal of existing waxes and sealers, dust, dirt, debris and any other contamination that may act as a bond breaker. Substrate preparation must be by mechanical means, such as shot blasting.

3.2 APPLICATION OF ARDEX FEATHER FINISH® XF™:

A. Examine substrates and conditions under which materials will be installed. Do not proceed with installation until unsatisfactory conditions are corrected.

B. Coordinate installation with adjacent work to ensure proper sequence of construction. Protect adjacent areas from contact due to mixing and handling of materials.

C. Priming: Comply with manufacturer's printed instructions.

D. Mixing: Comply with manufacturer's printed instructions.

E. Application: Comply with manufacturer's printed instructions and the following.

1. ARDEX FEATHER FINISH XF™ can be installed from a true featheredge up to 1/2" (12.7 mm) over large areas. It can also be installed up to any thickness in small, well-defined areas.

2. Apply the ARDEX FEATHER FINISH XF™ to the substrate with the flat side of a trowel to obtain a solid mechanical bond before applying the desired thickness.

F. Curing

1. As soon as the ARDEX FEATHER FINISH XF™ can be worked on without damaging the surface (15-20 minutes), standard floor coverings such as VCT, sheet vinyl and carpeting can be installed. If installing wood flooring, or, if high-performance adhesives will be used, such as epoxies or urethanes, ARDEX FEATHER FINISH XF™ must first cure for 16 hours (70°F).

3.3 FIELD QUALITY CONTROL

A. Where specified, field sampling of the ARDEX underlayment is to be done by taking an entire unopened bag of the product being installed to an independent testing facility to perform

compressive strength testing in accordance with ASTM C 109/modified: air-cure only. There are no in situ test procedures for the evaluation of compressive strength.

3.4 PROTECTION

A. Prior to the installation of the finish flooring, the surface of the underlayment should be protected from abuse by other trades by the use of plywood, Masonite or other suitable protection course.

1. ARDEX FEATHER FINISH XF™ can be installed from a true featheredge up to 1/2" (12.7 mm) over large areas. It can also be installed up to any thickness in small, well-defined areas.

2. Apply the ARDEX FEATHER FINISH XF™ to the substrate with the flat side of a trowel to obtain a solid mechanical bond before applying the desired thickness.

B. Curing

1. As soon as the ARDEX FEATHER FINISH XF™ can be worked on without damaging the surface (15-20 minutes), standard floor coverings such as VCT, sheet vinyl and carpeting can be installed. If installing wood flooring, or, if high-performance adhesives will be used, such as epoxies or urethanes, ARDEX FEATHER FINISH XF™ must first cure for 16 hours (70°F).

3.5 FIELD QUALITY CONTROL

A. Where specified, field sampling of the ARDEX underlayment is to be done by taking an entire unopened bag of the product being installed to an independent testing facility to perform

END OF SECTION

SECTION 03 1000

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Formwork for cast-in-place concrete as indicated.

2. Installation of items to be embedded in concrete, such as anchor bolts, inserts, embeds, and sleeves.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 03 2000: Concrete Reinforcing.

3. Section 03 3000: Cast-In-Place Concrete.

1.02 REFERENCES

A. American Concrete Institute (ACI) Publication:

1. ACI 318 – Building Code Requirements for Structural Concrete, Chapter 6, Formwork, Embedded Pipes, and Construction Joints.

2. ACI 347 – Guide to Formwork for Concrete.

B. American Plywood Association (APA):

1. Form No. V345 - Concrete Forming Design/Construction Guide.

C. National Institute of Standards and Technology (NIST):

1. NIST Voluntary Product Standard PS 1.

1.03 SUBMITTALS

A. Submit detailed structural calculations and drawings approved and signed by a California registered Civil Engineer where the height of the falsework or vertical shoring, as measured from the top of the sills to the soffit of the superstructure exceeds 14 feet, or where individual horizontal span lengths exceed 16 feet, or where provision for vehicular traffic through

falsework or shoring occurs. For all other falsework and shoring submit layout signed by California registered Civil Engineer, manufacturer's authorized representative or a licensed contractor experienced in the usage and erection of falsework and vertical shoring. A copy of the plans and calculation shall be available at the jobsite at all times.

B. Shop Drawings: Submit Shop Drawings indicating locations of forms, construction and expansion joints, embedded items, and accessories.

C. Product Data: Submit manufacturer's Product Data for form materials and accessories.

1.04 REGULATORY REQUIREMENTS

A. California Building Code (CBC), Chapter 19A.

B. California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 4, Construction Safety Orders, Article 6, Excavations, Sections 1713 and 1717.

1.05 DELIVERY, STORAGE AND HANDLING

A. Storage shall prevent damage and permit access to materials for inspection and identification.

PART 2 - PRODUCTS

2.01 GENERAL

A. Form materials may be reused during progress of the Work provided they are completely cleaned and reconditioned, recoated for each use, capable of producing formwork of required quality, and are structurally sound.

B. Form Lumber: WCLIB Construction Grade or Better, WWPA No. 1 or Better.

C. Plywood: NIST Voluntary Product Standard PS 1, Group 1, Exterior Grade B-B Plyform or better, minimum 5-ply and 3/4 inch thick for exposed locations and at least 5/8 inch thick for unexposed locations, grade marked, not mill oiled. Furnished plywood with medium or high density overlay is permitted.

D. Coated Form Plywood: For exposed painted concrete, plastic overlaid plywood of grade specified above, factory coated with a form coating and release agent Nox-crete", or equal.

E. Tube Forms: Sonoco "Seamless Sonotubes," Ceme-Tube, Quik-Tube, or equal, of the type leaving no marks in concrete, one-piece lengths for required heights.

F. Joist Forms: Code recognized steel or molded plastic types as required.

G. Special Forms: For exposed integrally-colored concrete, plywood as above with high density overlay, plywood with integral structural hardboard facing or fibrous glass reinforced plastic facing, providing specified finish.

H. For Exposed Concrete Finish:

1. Plywood: New, waterproof, synthetic resin bonded, exterior type Douglas fir or Southern pine plywood manufactured especially for concrete formwork and conforming to NIST Voluntary Product Standard PS 1, Grade B-B grade, Class I.

2. Glass-Fiber-Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to structural tolerances and appearance of finished concrete surfaces.

3. Steel: Minimum 16 gage sheet, well matched, tight fitting, stiffened to support weight of concrete, without deflection detrimental to tolerances and appearances of finished concrete surfaces.

4. Plywood: "Finland Form,," "Combi Form" by North American Plywood Corporation, “Plyform” by Roy O. Martin, “ProForm” by Pacific Wood Laminates, or equal. The material shall be furnished with hard smooth birch face veneers with phenolic resin thermally fused onto panel sides. Edges shall be factory sealed.

I. Form Ties: Prefabricated rod, flat band, wire, internally threaded disconnecting type, not leaving metal within 1 1/2-inch of concrete surface.

J. Form Coating: Non-staining clear coating free from oil, silicone, wax, not grain-raising, "Formshield" by A.C. Horn, Inc., "Release" by Edoco/Dayton Superior, "Cast-Off" by Sonneborn/BASF Building Systems or equal. Where form liners are furnished, provide form coatings recommended by form liner manufacturer.

K. Form Liner: Rigid or resilient type by L.M. Scofield, Symons, Greenstreak, or equal.

L. Void Forms: Manufactured by SureVoid Products, Inc., Sonotube, Void Form International, or equal. Forms shall be "WallVoid" for temporary support of concrete walls and grade beams spanning between supports, and "SlabVoid" for creating gaps between concrete slabs or steps and underlying soils. Void forms shall be fabricated of corrugated paper with moisture resistant exterior, and shall be capable of withstanding working load of 1,500 psf. Provide accessories as required.

PART 3 - EXECUTION

3.01 GENERAL

A. Forms shall be constructed so as to shape final concrete structure conforming to shape, lines and dimensions of members required by Drawings and Specifications, and shall be sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together to maintain position and shape. Forms and their supports shall be designed so that previously placed structures will not be damaged.

B. Use form coating at all surfaces in contact with concrete.

3.02 TOLERANCES

A. Permitted abrupt or gradual irregularities in formed surfaces as measured within a 5 feet length with a straightedge shall per ACI 347, Table 3.1:

Class of Surface			
A	B	C	D
1/8 inch	1/4 inch	1/2 inch	1 inch

Edit Note: Edit tolerances indicated below for project specifics.

1. Class A: Use for concrete surfaces prominently exposed to public view.

2. Class B: Use for coarse-textured concrete-formed surfaces intended to receive plaster, stucco or wainscoting.

3. Class C: Use as a general standard for permanently exposed surfaces where other finishes are not specified.

4. Class D: Use for surfaces where roughness is not objectionable and will be permanently concealed.

3.03 ERECTION

A. Plywood shall be installed with horizontal joints level, vertical joints plumb and with joints tight. Back joints by studs or solid blocking, and fill where necessary for smoothness. Reused plywood shall be thoroughly cleaned, damaged edges or surfaces repaired and both sides and edges oiled with colorless form oil. Nail plywood along edges, and to intermediate supports, with common wire nails spaced as necessary to maintain alignment and prevent warping.

B. Openings for Cleaning: Provide temporary openings at points in formwork to facilitate cleaning and inspection. At base of walls and wide piers, bottom form board on one face for entire length shall be omitted until form has been cleaned and inspected.

C. Chamfers: Provide 3/4 inch by 3/4 inch chamfer strips for all exposed concrete corners and edges unless otherwise indicated.

D. Reglets and Rebates: As specified in Section 03 3000: Cast-In-Place Concrete.

3.04 REMOVAL OF FORMS

A. Forms shall not be removed until concrete has sufficiently hydrated to maintain its integrity and not be damaged by form removal operations. Unless noted otherwise and/or permitted by

the Architect, columns and wall forms shall not be removed in less than five days, floor slabs in less than seven days, beams and girders in less than 15 days, pan forms for joists may be removed after three days, but joist centering shall not be removed until after 15 days, and ramp, landing, steps and floor slabs shall not be removed in less than seven days. Shoring shall not be removed until member has acquired sufficient strength to support its weight, load upon it, and added load of construction.

B. Compressive strength of in-place concrete shall be determined by testing field-cured specimens representative of concrete location or members, as specified in Section 03 3000: Cast-In-Place Concrete.

3.05 PROTECTION

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

3.06 CLEAN UP

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

END OF SECTION

SECTION 03 2000

CONCRETE REINFORCING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Concrete steel reinforcement.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 01 4523: Testing and Inspection.

3. Section 03 1000: Concrete Forming.

4. Section 03 3000: Cast-In-Place Concrete.

1.02 REGULATORY REQUIREMENTS

A. Fabrication and placement of reinforcing shall be in accordance with requirements of CBC, Chapter 19A.

1.03 REFERENCES

A. ASTM International:

1. ASTM A184 - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement.

2. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

3. ASTM A706 - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.

4. ASTM A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

B. American Concrete Institute (ACI) Publication:

1. ACI SP-66 – ACI Detailing Manual.

2. ACI 318 – Building Code Requirements for Structural Concrete, as modified by CBC.

C. American Welding Society (AWS):

1. AWS D1.4 – Structural Welding Code – Reinforcing Steel.

1.04 SUBMITTALS

A. Shop Drawings: Submit steel reinforcement Shop Drawings. Include assembly diagrams, schedule of reinforcement, bending charts and slab and framing plans. Indicate lengths and location of splices, size and lengths of reinforcing steel.

B. Closeout Submittals: Record exact locations of reinforcing that vary from Contract Documents.

1.05 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice.

2. American Welding Society (AWS).

3. American Concrete Institute (ACI).

4. CBC, Chapter 19A, Concrete.

B. Source Quality Control: Refer to Division 01 Sections for general requirements and to the following paragraphs for specific procedures. Testing laboratory retained by the OWNER shall select test Samples of bars, ties, and stirrups from the material at the Project Site or from the place of distribution, with each Sample consisting of not less than two 18 inch long pieces, and perform the following tests according to ASTM A615, or ASTM A706, as applicable:

1. Identified Bars: If Samples are obtained from bundles as delivered from the mill, identified as to heat number, accompanied by mill analyses and mill test reports, and properly tagged with the identification certificate so as to be readily identified, perform one tensile and one bend test for each 10 tons or fraction thereof of each size of bars. Submit mill reports when Samples are selected.

2. Unidentified Bars: When positive identification of reinforcing bars cannot be performed and when random Samples are obtained; perform tests for each 2.5 tons or fraction thereof, one tensile and one bend test from each size of bars.

C. Certification of Welders: Shop and Project site welding shall be performed by welding operators certified by AWS.

1.06 DELIVERY, STORAGE AND HANDLING

A. Avoid exposure to dirt, moisture or conditions harmful to reinforcing.

B. Reinforcing steel bars, wire, and wire fabric shall be stored on the Project site to permit easy access for examination and identification of each shipment. Material of each shipment shall be separated for size and shape.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide reinforcing of sizes, gages and lengths indicated, bent to indicated shapes.

2.02 MATERIALS

A. Steel Reinforcing Bars:

1. ASTM A615, deformed grade 60 or 75 billet steel, as indicated on the drawings.

2. Weldable reinforcing bars shall conform to ASTM A706.

B. Bars or Rod Mats: ASTM A184.

C. Welded Wire Fabric for Reinforcement: ASTM A1064.

D. Tie Wire: ASTM A1064, fully annealed, copper-bearing steel wire, 16 gage minimum.

E. Chairs, Spacers, Supports, and Other Accessories: Standard manufacture conforming to ACI 315 fabricated from steel wire of required types and sizes. For reinforcement supported from grade, provide properly sized dense precast blocks of concrete.

2.03 FABRICATION OF REINFORCING BARS

A. Comply with CRSI Manual of Standard Practice for Reinforced Concrete Construction for fabrication of reinforcing steel.

B. Bending and Forming: Fabricate bars of the indicated sizes and bend and form to required shapes and lengths by methods not injurious to materials. Do not heat reinforcement for bending. Bend bars No. 6 size and larger in the shop only. Bars with unscheduled kinks or bends are not permitted. Provide only tested and permitted bar materials.

C. Welding: Provide only ASTM A706 steel where welding is indicated. Perform welding by the direct electric arc process in accordance with AWS D1.4 and specified low-hydrogen electrodes. Preheat 6 inches each side of joint. Protect joints from drafts during the cooling process; accelerated cooling is not permitted. Do not tack weld bars. Clean metal surfaces to be welded of loose scale and foreign material. Clean welds each time electrode is changed and chip burned edges before placing welds. When wire brushed, the completed welds must exhibit uniform section, smooth welded metal, feather edges without undercuts or overlays, freedom from porosity and clinkers, and good fusion and penetration into the base metal. Cut out welds or parts of welds deemed defective, using chisel, and replace with proper welding. Prequalification of welds shall be in accordance with CBC requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Bars shall be bent cold. Bars partially embedded in concrete shall not be field bent except as indicated on reviewed Shop Drawings.

B. Before installation and just prior to placing concrete, clean reinforcing of loose scale, rust, oil, dirt and any coating that could reduce bond.

C. Accurately position, install, and secure reinforcing to prevent displacement during the placement of concrete.

D. Provide metal chairs to hold reinforcement the required distance above form bottoms. In beams and slab construction, provide chairs under top slab reinforcement as well as under bottom reinforcement. Space chairs so that reinforcement will not be displaced during installation. Provide metal spacers to secure proper spacing. Stirrups shall be accurately and securely wired to bars at both top and bottom. At slabs, footings, and beams in contact with earth, provide concrete blocks to support reinforcement at required distance above grade.

E. Install and secure reinforcement to maintain required clearance between parallel bars and between bars and forms. Lapped splices shall be installed wherever possible in a manner to provide required clearance between sets of bars. Stagger lapped splices. Dowels and bars extending through construction joints shall be secured in position against displacement before concrete is installed and subsequently cleaned of concrete encrustations while they are still soft.

F. Do not install reinforcing in supported slabs and beams until walls and columns have been installed to underside of slabs and beams or until construction joints have been thoroughly cleaned. Reinforcing shall be inspected before placement of concrete and cleaned as required.

G. Use deformed bars unless otherwise indicated, except for spiral reinforcement.

3.02 CLEAN UP

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

3.03 PROTECTION

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

END OF SECTION

SECTION 03 3000

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Cast-in-place normal weight and lightweight concrete, placement and finishing.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 03 1000: Concrete Forming and Accessories.

3. Section 03 2000: Concrete Reinforcing.

4. Section 32 1313: Site Concrete Work.

1.02 REFERENCES

A. American Concrete Institute (ACI) Publication:

1. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.

2. ACI 301 – Specifications for Structural Concrete.

3. ACI 302.1R – Guide for Concrete Floor and Slab Construction.

4. ACI 305R - Specification for Hot Weather Concreting.

5. ACI 306.1 – Standard Specification for Cold Weather Concreting.

6. ACI 308R – Guide to External Curing of Concrete.

7. ACI 318 - Building Code Requirements for Structural Concrete, as modified by CBC Sections 1903A and 1905A.

B. American Society for Testing and Materials (ASTM) Standards:

1. ASTM C31 – Standard Specification for Making and Curing Concrete Test Specimens in the Field.

2. ASTM C33 - Standard Specification for Concrete Aggregates.

3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

4. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

5. ASTM C88 - Standard Test Method for Soundness of Aggregates by use of Sodium Sulphate or Magnesium Sulphate.

6. ASTM C94 - Standard Specification for Ready-Mixed Concrete.

7. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

8. ASTM C150 - Standard Specification for Portland Cement.

9. ASTM C156 – Standard Test Method for Water Loss (from a Mortar Specimen) Through Liquid membrane-Forming Curing Compounds for Concrete.

10. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.

11. ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete.

12. ASTM C173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

13. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.

14. ASTM C289 - Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).

15. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

16. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.

17. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.

18. ASTM C567 - Standard Test Method for Determining Density of Structural Lightweight Concrete.

19. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

20. ASTM C845 - Standard Specification for Expansive Hydraulic Cement

21. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.

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

23. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.

24. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.

25. ASTM C1315 – Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

26. ASTM D1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.

27. ASTM C1567 - Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method).

28. ASTM D1751 - Standard Test Method for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

29. ASTM D7234 – Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.

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

31. ASTM E1155 - Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers.

32. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.

33. ASTM E1745 - Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

34. ASTM F710 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

35. ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

36. ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes.

37. ASTM F3010 – Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use under Resilient Floor Coverings.

1.03 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings indicating locations of cast-in-place concrete Work and accessory items such as vapor barriers. Include details and locations of reinforcing, embedded items, and interfacing with other Work.

B. Mix Design Data: Submit concrete mix designs as specified herein and in Article 2.02.

1. Submit name, address and telephone number of the concrete production facility which the contractor intends to engage to design the concrete mixes. Submit name and qualifications of the proposed concrete technologist.

2. Mix Design: Submit a concrete mix design for each strength and type of concrete indicated in the drawings or specified. Include water/cement ratio, source, size and amount of coarse aggregate and admixtures. Predict minimum compressive strength, maximum slump and air content percentage. Clearly indicate locations where each mix design will be used.

a. Water/cement ration for concrete slabs on grade shall be 0.50 maximum.

3. Test Reports: Submit copies of test reports showing that the proposed mixes produce concrete with the strengths and properties specified. Include tests for cement, aggregates and admixtures. Provide gradation analysis.

C. Material Samples: Submit Samples illustrating concrete finishes and hardeners, minimum 12-inch by 12-inch.

D. Certificates: Submit certification that each of the following conforms to the standards indicated:

1. Portland cement: ASTM C150.

2. Normal weight concrete aggregates: ASTM C33.

3. Lightweight concrete aggregates: ASTM C330.

4. Aggregates: Submit evidence that the aggregate is not reactive in the presence of cement alkalis. In the absence of evidence, aggregate shall be tested by one of the methods in ASTM C33 Appendix XI, Methods for Evaluating Potential for Deleterious Expansion Due to Alkali Reactivity of an Aggregate. . Aggregates deemed to be deleterious or potentially deleterious may be used with the addition of a material that has been shown to prevent harmful expansion in accordance with Appendix XI of ASTM C33, when approved by the building official, in accordance to CBC Section 1903A5A.

5. Curing materials: ASTM C171.

E. Admixtures: Submit product data for proposed concrete admixtures.

1.04 QUALITY ASSURANCE

A. Continuous inspection shall be provided at the batch plant and for transit-mixed concrete to run check sieve analysis of aggregate, check moisture content of fine aggregate, check design of mix, check cement being used with test reports, check loading of mixer trucks, and certify to quantities of materials placed in each mixer truck.

B. Inspection shall be performed by a representative of a testing laboratory selected by the OWNER. OWNER will pay for inspection costs. Notify the laboratory 24 hours in advance of time concrete

is to be mixed. Notify the laboratory of postponement or cancellation of mixing within at least 24 hours of scheduling time.

C. CONTRACTOR shall assist the testing laboratory in obtaining and handling samples at the project site and at the source of materials.

D. Continuous batch plant inspection requirement may be waived in accordance with CBC Section 1705A.3.3.1. Waiver shall be in writing, including DSA approval. When batch plant inspection is waived by DSA, the following requirements shall be met:

1. Approved inspector of the testing laboratory shall check the first batching at the start of work and furnish mix proportions to the licensed weightmaster.

2. Licensed weightmaster shall positively identify materials as to quantity and certify to each load by a ticket.

3. Tickets shall be transmitted to the Inspector by a truck driver with load identified thereon. The Inspector will not accept the load without a load ticket identifying the mix and will keep a daily record of placements, identifying each truck, its load and time of receipt and approximate location of deposit in the structure and will transmit a copy of the daily record to DSA.

4. At the end of the project, the weightmaster shall furnish an affidavit to DSA certifying that all concrete furnished conforms in every particular to proportions established by mix designs.

E. Special Inspections and Tests shall be in accordance with CBC Chapter 17A, Reinforcement and Anchor testing per CBC Section 1910A and Specification Section 01 4523.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store cement and aggregate materials so as to prevent their deterioration or intrusion by foreign matter. Deteriorated or contaminated materials shall not be furnished.

B. Packaged materials shall bear the manufacturers and brand name label, and shall be stored in their original unbroken package in a weather tight place until ready for use in the work.

1.06 PROJECT CONDITIONS

A. Cold Weather Requirements: Batching, mixing, delivering and placing of concrete in cold weather shall comply with the applicable requirements of ACI 306.1.

B. Hot Weather Requirements: Batching, mixing, delivering and placing of concrete in hot weather shall comply with the applicable requirements of ACI 305R.

C. Concrete temperature of freshly mixed concrete shall be determined per ASTM C1064.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cement: ASTM C150. Portland Cement.

B. Aggregates: Conform to the following standards:

1. Normal weight concrete: ASTM C33.

2. Lightweight concrete: ASTM C330, with fine aggregates per ASTM C33.

3. Aggregate shall be tested for Potential Alkali Reactivity of Cement-Aggregate Combinations per ASTM C289.

4. Nominal maximum size of coarse aggregate shall be no larger than:

a. 1/5 the narrowest dimension between sides of forms, nor

b. 1/3 the depth of slabs, nor

c. 3/4 the clear spacing between individual reinforcing bars or wires, bundles of bars, individual tendons, or ducts.

d. CONTRACTOR may request the ARCHITECT and DSA waiver of the above limitations reported per ACI 318, provided that the workability and methods of consolidation are such that the concrete can be placed without honeycombs or voids.

C. Water: Water for concrete mixes, curing and cleaning shall be potable and free from deleterious matter.

D. Admixtures: Shall be shown capable of maintaining essentially the same composition and performance throughout the work as the product used in establishing concrete proportions in accordance with ACI 318, Section 3.6.

1. Admixtures containing chlorides or sulfides are not permitted.

2. Air-entraining admixtures shall comply with ASTM C260. Air-entrained admixtures shall not be used for floor slabs to receive steel trowel finish.

3. Admixtures for water reduction and setting time modification shall conform to ASTM C494.

4. Admixtures for producing flowing concrete shall conform to ASTM C1017.

5. Fly ash, pozzolan and ground granulated blast-furnace slag: Modify ACI 318 Sections 3.6.6 and 3.6.7 as follows:

a. Fly ash or other pozzolan used as a partial substitution for ASTM C150 Portland cement shall meet the following requirements:

1) Shall conform to ASTM C618 for Class N or F materials (Class C is not permitted).

2) [ ] percent by weight of fly ash or other pozzolans shall substitute for ASTM C150 Portland cement provided the mix design is proportioned per ACI 318, Section 318 5.3.

b. Ground-granulated blast-furnace slag used as a partial substitution for ASTM C150 Portland cement shall meet the following requirements:

1) Shall conform to ASTM C989.

2) [ ] percent by weight of ground-granulated blast-furnace slag shall substitute for ASTM C150 Portland cement provided the mix design is proportioned per ACI 318, Section 5.3.

6. Admixtures containing ASTM C845 expansive cements shall be compatible with the cement and produce no deleterious effects.

7. Silica fumes used as an admixture shall conform to ASTM C1240.

E. Reinforcement Fibers: Chop strands of alkali-resistant polypropylene or nylon fibers added to the concrete mix for protection against shrinkage cracks.

F. Expansion Joint Fillers: Preformed strips, non-extruding and resilient bituminous type, of thickness indicated, conforming to ASTM D1751.

G. Curing:

1. Curing Paper: Shall conform to ASTM C171 and consist of two sheets of kraft paper cemented together with a bituminous material in which are embedded cords or strands of fiber running in both directions. The paper shall be light in color, shall be free of visible defects, with uniform appearance.

2. Elevated slabs and slabs on grade may be cured at CONTRACTOR's option with curing and proactive water vapor emission and alkalinity control system. Products shall be approved by OWNER's Office of Environmental Health and Safety.

a. VaporSeal 309, by Floor Seal Technology, Inc., or equal.

1) ASTM C156: 0.39 kg/m².

2) ASTM C309: Exceeds requirements.

3) ASTM C1315: Exceeds requirements.

4) ACI 308R-01 Compliant.

b. Remedial Treatment: Water vapor emission and alkalinity control treatment, MES 100 by Floor Seal Technology, Inc. or equal.

1) ASTM E96: <0.1 Perms.

2) ASTM D1308: 14pH Resistant.

3) ASTM D7234: 500+psi 100% concrete failure.

4) ASTM F2170: 100%RH resistant.

5) VOC Content: <100 g/L, meets SCAQMD Rule #1113.

6) ASTM F3010: Meets Requirements.

c. Self-leveling Compounds: Ardex Engineered Cements, K15, or V1200, Schonox ZM Rapid, US Self Leveler Armstrong, S-194, or equal.

H. Floor Hardener: Water soluble, inorganic, silicate-based curing, hardening, sealing and dustproofing compound. Aquaseal W20 by Monopole Inc., Kure-N-Harden by BASF, Chem Hard by L&M, Liqui-Hard by W. R. Meadows, or equal.

I. Underlayment: Two component latex underlayment for filling low spots in concrete for both interior and exterior applications, from featheredge to a maximum of 3/8 inch in thickness. Underlayment shall be non-shrink and suitable for repairing exposed concrete surfaces and for underlayment of carpet, resilient, tile and quarry floor coverings. La-O-Tex by TexRite, Underlay C, RS by Mer-Krete Systems, Underlayment 962 by C-Cure, or equal.

J. Grout: ASTM C1107, non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 7 days; of consistency suitable for application and a 30 minute working time.

2.02 CONCRETE MIX

A. Mix shall be signed and sealed by a Civil or Structural Engineer currently registered in the State of California.

B. Strength of Concrete: Strengths and types of concretes shall be as indicated in the Drawings. Unless otherwise indicated or specified, concrete shall be provided with minimum 28-day strength of 3000 psi (f'c).

C. Concrete mix shall meet the durability requirements of ACI 318, Chapter 4.

D. Concrete proportioning shall be determined on the basis of field experience and/or trial mixtures shall in accordance with ACI 318, Section 5.3. Proportions of materials shall provide workability and consistency to permit concrete to be placed readily into forms and around reinforcement under conditions of placement to be employed, without segregation or excessive bleeding.

E. Ready-Mixed Concrete: Mix and deliver in accordance with requirements of ASTM C94.

PART 3 - EXECUTION

3.01 GENERAL

A. Surfaces to receive concrete shall be free of debris, standing water, and any other deleterious substances before start of concrete placing.

B. Time of Placing: Do not place concrete until reinforcement, conduits, outlet boxes, anchors, hangers, sleeves, bolts, and other embedded materials are securely fastened in place. Contact the Inspector at least 24 hours before placing concrete; do not place concrete until inspected by the Project Inspector.

C. Pouring Record: A record shall be kept on the Project site of time and date of placing concrete in each portion of structure. Such record shall be maintained on the Project site until Substantial Completion and shall be available for examination by the ARCHITECT and DSA.

3.02 TOLERANCES

A. Concrete construction tolerances shall be as specified in ACI 117 and as modified herein.

B. Floor Flatness (F_F) and Floor Levelness (F_L) shall be as indicated below:

	Specified Overall Value		Minimum Local Value	
	F_F	F_L	F_F	F_L
Slabs on ground: mechanical and electrical rooms, parking structures and mortar bed set tile and quarry flooring.	20	15	15	10
Slab on ground: carpet.	25	20	17	15
Slab on ground: thinset tile and resilient flooring.	35	25	24	17
Suspended slabs: mechanical and electrical rooms, parking structures and mortar bed set tile and quarry flooring.	20	15	N/A	N/A
Suspended slabs: carpet.	25	20	N/A	N/A
Suspended slabs: thinset tile and resilient flooring.	35	20	N/A	N/A

C. Refer to ACI 302.1R, Tables 8.1 and 8.2 Slab on Ground and Suspended Flatness/Levelness Construction Guide, for recommended concrete placing and finishing methods.

D. Floor Flatness and Floor Levelness shall be tested in accordance to ASTM E1155. Floor measurements shall be made within 48 hours after slab installation, and shall precede removal of shores and forms.

3.03 PREPARATION

A. Reglets and Rebates:

1. Form reglets and rebates in concrete to receive flashing, frames and other equipment as detailed and required. Coordinate dimensions and locations required with other related Work.

2. If concrete slabs on grade adjoin a wall or other perpendicular concrete surface, form a reglet in wall to receive and carry horizontal concrete Work. Reglet shall be full thickness of the slab and shall be 3/4 inch wide, unless otherwise indicated. Requirement does not apply to exterior walks, unless specifically indicated.

B. Screeds: Install screeds accurately and maintain at required grade or slab elevations after steel reinforcement has been installed, but before starting to place concrete. Install screeds adjacent to walls and in parallel rows not to exceed 8 feet on centers.

3.04 INSTALLATION

A. Conveying and Placing:

1. Concrete shall be placed only under direct observation of the Project Inspector. Do not place concrete outside of regular working hours, unless the Inspector has been notified at least 48 hours in advance.

2. Concrete shall be conveyed from mixer to location of final placement by methods that will prevent separation or loss of materials.

3. Concrete shall be placed as nearly as practicable to its final position to avoid segregation due to re-handling or flowing. No concrete that has partially hydrated or has been contaminated by foreign materials shall be placed, nor shall re-tempered concrete or concrete which has been remixed after initial set be placed.

4. In placing concrete in columns, walls or thin sections, provide openings in forms, elephant trunks, tremies or other recognized devices, to prevent segregation and accumulation of partially hydrated concrete on forms or metal reinforcement above level of concrete being placed. Such devices shall be installed so that concrete will be dropped vertically. Unconfined vertical drop of concrete from end of such devices to final placement surface shall not exceed 6 feet.

5. Concrete shall be placed as a continuous operation until placing of panel or section is completed. Top surfaces of vertically formed lifts shall be level.

6. Concrete shall be thoroughly consolidated by suitable means during placement, and shall be thoroughly worked around reinforcement and embedded fixtures and into corners of forms.

7. Where conditions make consolidation difficult or where reinforcement is congested, batches of mortar containing same proportions of cement, sand, and water as provided in the concrete, shall first be deposited in the forms to a depth of at least one inch.

B. Cold Weather:

1. Provide adequate equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather. All ground with which concrete is to come in contact shall be free from frost. No frozen materials or materials containing ice shall be used.

2. The temperature of concrete at the time of placement shall not be below the minimum temperatures given in Table 3.1 of ACI 306.1.

3. Concrete shall be maintained at a temperature of at least 50° F. for not less than 72 hours after placing or until it has thoroughly hardened. Cover concrete and provide sufficient heat as required. When necessary, aggregates shall be heated before mixing. Special precautions shall be taken for protection of transit-mixed concrete.

C. Hot Weather:

1. Concrete to be placed during hot weather shall comply with the requirements of ACI 318, Section 5.13.

2. Maintain concrete temperatures indicated in Table 2.1.5 of ACI 305R to prevent the evaporation rate from exceeding 0.2 pound of water per square feet of exposed concrete per hour.

3. Cool concrete using methods indicated in ACI 305R Appendix B.

4. Place and cure concrete as specified in ACI 305R Chapter 4.

D. Compaction and Screeding:

1. Tamp freshly placed concrete with a heavy tamper until at least 3/8 inch of mortar is brought to surface. Concrete shall then be tamped with a light tamper and screeded with a heavy straightedge until depressions and irregularities are eliminated, and surface is true to finish grades or elevations. Remove excess water and debris.

2. Where slabs are to receive separate cement finish or mortar setting bed, continued tamping to raise mortar to surface is not performed. Laitance shall be removed by brushing with a stiff brush or by light sandblasting to expose clean top surface of coarse aggregate.

E. Floating and Troweling:

1. When concrete has hydrated sufficiently, it shall be floated to a compact and smooth surface. After floating, wait until concrete has reached proper consistency before troweling. Top surfaces shall receive at least 2 troweling operations with steel hand trowel. Prior to and during final troweling, apply a fine mist of water frequently with an atomizing type fog sprayer. Omit troweling for slabs to receive a separate cement finish.

2. For interior finish slabs, final troweling shall provide a hard, impervious, and non-slip surfaces, free from defects and blemishes. Finished surface shall be within tolerances indicated in Article 3.02. Avoid burnishing. Do not add cement or sand to absorb excess moisture.

   a. Floor of Walk-In Refrigerator: Finish as specified above, to a smooth finish.

b. Floor of Gymnasium Locker Rooms: After floating, and while the surface is still plastic, provide a fine textured finish by drawing a fine fiber bristle broom uniformly over the surface in one direction only. Floors sloped for drainage should be brushed in the direction of flow.

3. Vertical concrete surfaces shall be finished smooth and free from marks or other surface defects.

3.05 CURING

A. Length of time, temperature and moisture conditions for curing concrete shall be in accordance with ACI 318, Section 5.11.

B. Forms containing concrete, top of concrete between forms, and exposed concrete surfaces after removal of forms shall be maintained in a thoroughly wet condition for at least 7 consecutive days after placing.

C. If weather is hot or surface has dried out, spray surface of concrete slabs and paving with fine mist of water, starting not later than 2 hours after final troweling and continuing until sunset. Surface of finish shall be kept continuously wet until curing medium has been installed.

D. Immediately after finishing, monolithic floor slabs shall be covered with curing paper. Paper shall be lapped 4 inches at joints and sealed with waterproof sealer. Edges shall be cemented to finish. Repair or replace paper damaged during construction operations.

E. When curing slabs with proactive water vapor emission and alkalinity control system:

1. Coordinate and schedule application of curing compound with concrete pour schedule, while conforming to manufacturer’s application instructions.

2. When the surface of the concrete has hardened sufficiently to sustain foot traffic pre-cure slabs with liquefied product application following manufacturer’s written instructions. Application shall be by trained applicators.

3. Monitor Environmental Conditions: Set up weather station 20 to 30 inches above freshly placed concrete. Record temperature, humidity and wind velocity measurements at 15 minute maximum intervals.

4. Calculate Evaporation Rate: Use recorded weather information in combination with nomograph per ACI 308R, Figure 4.1, Guide to Curing Concrete, to evaluate relevant evaporation rate.

5. When the bleed water rate of the concrete is approximately equal to the surface water evaporation rate, spray curing compound material throughout surface of slabs and decks, following manufacturer’s written instructions. Application shall be by trained applicators.

6. Perform the following tests at least 28 days after placement of concrete and prior to floor covering installation. Submit to OAR test results indicating locations that do not comply with scheduled flooring installation requirements.

a. Calcium chloride testing per ASTM F1869.

b. Relative humidity testing per ASTM F2170.

c. Alkalinity testing per ASTM F710.

d. Perform concrete bond layer humidity meter testing to determine substrate surface acceptability.

7. Areas emitting moisture and alkalinity at rates exceeding floor covering manufacturer's published ASTM F1869 limits, shall receive a corrective coating, at no cost to the OWNER, as follows:

a) Mask and protect adjacent walls and floor surfaces from effects of scarification and application of remedial treatment.

b) Scarify slab surface in area of application by shot blasting or other method acceptable to corrective coating manufacturer.

c) Prepare and fill cracks, control joints and cold joints.

d) Apply two-component modified epoxy penetrant and coating with roller and squeegee over required treatment area; saturate surfaces to ensure a through mechanical bond.

e) Clean and fill divots, chips, voids and other surface irregularities with one hundred percent Portland cement based patching compound or cementitious fill.

f) Apply cementitious surfacing over coating in areas to receive resilient and wood floor coverings to facilitate adhesion; apply to a thickness of 1/8 inch.

3.06 FILLING, LEVELING AND PATCHING

A. Concrete slabs exhibiting high or low spots and indicated to receive resilient floor covering or soft floor covering, shall have surfaces repaired. High spots shall be honed, or ground with power-driven machines to required tolerances. Low spots shall be filled with latex underlayment, installed in strict accordance with manufacturer's written recommendations.

B. Holes resulting from form ties or sleeve nuts shall be solidly packed, through exterior walls, by pressure grouting with cement grout, as specified. Grouted holes on exposed surfaces shall be screeded flush and finished to match adjoining surfaces.

C. Cement Base: Cement base shall be of the height, thickness, and shape detailed. Base shall be reinforced with one inch mesh, 18 gage, zinc-coated wire fabric. Base finish mixture shall be one part Portland cement, 2 parts of fine aggregate and one part pea gravel. Colored cement base shall include a chemically inert mineral oxide pigment in the mix.

3.07 FINISHING

A. Soda and Acid Wash: Concrete surfaces to receive plaster, paint or other finish, and which have been formed by oil coated forms, shall be scrubbed with a solution of 1-1/2 pounds of caustic

soda to one gallon of water. Surfaces where smooth wood or waste molds have been furnished shall be scrubbed with a solution of 20 percent muriatic acid. Wash with clean water after scrubbing.

B. Sacking: Exposed concrete curbs, walls, and other surfaces shall be sacked by an application of Portland cement grout, floated, and rubbed. Sacking shall not be performed until patching and filling of holes has been completed. Entire sacking operation for any continuous area shall be started and completed within the same day.

1. Mix one part Portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having consistency of thick paint. Wet surface of concrete sufficiently to prevent absorption of water from grout. Apply grout uniformly with a brush or spray gun, then immediately float surface with a cork or other suitable float, scouring wall vigorously.

2. While grout is still plastic, finish surface with a sponge-rubber float, removing excess grout. Allow surface to dry thoroughly, then rub vigorously with dry burlap to completely remove dried grout. No visible film or grout shall remain after rubbing with burlap.

C. Sandblasting: Exterior concrete surfaces to receive stucco dash coat finish, where plywood or other smooth forms have been furnished, shall be uniformly sand-blasted with sharp quartz sand under sufficient air pressure to remove dirt, form oil and other foreign materials, and roughen surface to provide a proper bond. Such surfaces shall be thoroughly washed with clean water after sandblasting.

D. Abrasive: Concrete stair treads, landings, ramps and steps on interior and exterior of buildings, and interior exposed concrete floors in shop buildings shall receive an abrasive finish.

E. Floor Hardener: Exposed interior concrete floors throughout shall be treated with floor hardener.

1. Protect adjacent surfaces. Clean surfaces to receive treatment in accordance with manufacturer's instructions, ensuring that all stains, oil, grease, form release agents, laitance, dust and dirt are removed prior to application.

2. Apply hardener in accordance with manufacturer’s instructions as soon as concrete is firm enough to work on after final troweling.

F. Cement Grout and Dry-Pack Concrete: Cement grout shall be mixed at the Project site and shall be composed of one volume of Portland cement and 2-1/2 volumes of fine aggregate. Materials shall be mixed dry with sufficient water added to make mixture flow under its own weight. When grout is used as a dry pack concrete, add sufficient water to provide a stiff mixture, which can be molded into a sphere.

G. Broom Finish: Exterior stair treads and landings shall be provided with a non-slip broom finish in addition to abrasive finish specified.

H. Abrasive Stair Nosing: Nosing shall be installed according to manufacturers written recommendations.

3.08 EXPANSION AND CONSTRUCTION JOINTS

A. Construction Joints: Details and proposed location of construction joints shall be as indicated on the Drawings, located to least impair strength of structure, in accordance with the following:

1. Thoroughly clean contact surface by sand blasting entire surface not earlier than 5 days after initial placement.

2. A mix containing same proportion of sand and cement provided in concrete plus a maximum of 50 percent of coarse aggregate shall be placed to a depth of at least one inch on horizontal joints. Vertical joints shall be wetted and coated with a neat cement grout immediately before placing of new concrete.

3. Should contact surface become coated with earth, sawdust, or deleterious material of any kind after being cleaned, entire surface shall be re-cleaned before applying mix.

B. Expansion Joints: Provide expansion joints where indicated in walks and exterior slabs. Space approximately 20 feet apart, unless otherwise indicated. Joints shall extend entirely through slab with joint filler in one piece for width of walk or slab. Joint filler shall be 3/8 inch thick, unless otherwise indicated.

C. Tooled Joints: Slabs, walks and paving shall be marked into areas as indicated with markings made with a V-grooving tool. Marks shall be round-edged, free from burrs or obstructions, with clean cut angles and shall be straight and true. Walks, if not indicated, shall be marked off into rectangles of not more than 12 square feet and shall have a center marking where more than 5 feet wide.

3.09 TESTING

A. Molded Cylinder Tests:

1. Inspector or testing lab personnel will prepare cylinders and perform slump tests. Samples for concrete strength shall be taken in accordance to ASTM C172. Each cylinder shall be dated, given a number, point in structure from which sample was obtained, mix design number, mix design strength and result of accompanying slump test noted.

2. Separate tests of molded concrete cylinders obtained at same place and time shall be made at age of three days, seven days, and 28 days. A strength test shall be the average of the compressive strength of two cylinders, obtained from the same sample of concrete and tested at 28 days or at test age designated for determination of f'c.

3. Test cylinders shall be prepared at the Project site and stored in testing laboratory in accordance with ASTM C31, and tested in accordance with ASTM C39.

B. Core Test: At request of the ARCHITECT, cores of hardened concrete shall be cut from portions of hydrated structures for testing, in accordance with CBC and ASTM C42.

1. Provide 4 inch diameter cores at representative places throughout the structure as designated by the ARCHITECT.

2. In general, provide sufficient cores to represent concrete placed with at least one core for each 4,000 square feet of building area, and at least 3 cores total for each Project.

3. Where cores have been removed, fill voids with drypack, and patch the finish to match the adjacent existing surfaces.

C. Concrete Consistency: Measure consistency according to ASTM C143. Test twice each day or partial day's run of the mixer.

D. Adjustment of Mix: If the strength of any grade of concrete for any portion of Work, as indicated by molded test cylinders, falls below minimum 28 days compressive strength specified or indicated, adjust mix design for remaining portion of construction so that resulting concrete meets minimum strength requirements.

E. Air Content Testing: Measure in accordance to ASTM C173 or ASTM C231, for each composite sample taken in accordance to ASTM C172.

F. Defective Concrete:

1. Should strength of any grade of concrete, for any portion of Work indicated by tests of molded cylinders and core tests, fall below minimum 28 days strength specified or indicated, concrete will be deemed defective Work and shall be replaced or adequately strengthened in a manner acceptable to the ARCHITECT and DSA.

2. Concrete Work that is not formed as indicated, is not true within 1/250 of span, not true to intended alignment, not plumb or level where so intended, not true to intended grades and levels, contains sawdust shavings, wood or embedded debris, or does not fully conform to Contract provisions, shall be deemed to be defective Work and shall be removed and replaced.

G. Concrete for Equipment Pads, Mechanical and Electrical Work: Unless otherwise indicated, strength shall have a minimum f'c = 3,000 psi. Exposed concrete shall be provided with a hand trowel finish with radius corners and edges. Form and place concrete where necessary as described in Section 03 1000 Concrete Forming and Accessories, and reinforced as described in Section 03 2000 Concrete Reinforcing. Calcium chloride shall not be furnished in any concrete mix provided for the installation of underground electrical conduits. For concrete encasement of more than one conduit, furnish 3/4 inch maximum aggregate.

3.10 CLEAN UP

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

3.11 PROTECTION

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

END OF SECTION

SECTION 05 0513

HOT-DIP GALVANIZING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Hot-dip galvanizing of fabricated steel assemblies.

2. Preparation of galvanized steel assemblies for painting.

B. Related Sections:

1. Division 01 - General Requirements.

2. Section 05 1200: Structural Steel Framing.

3. Section 05 5000: Metal Fabrications.

4. 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 1200

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Structural steel.

2. Architecturally exposed structural steel.

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 0513 – Hot-Dip Galvanizing.

5. Section 05 5000 - Metal Fabrications.

6. Section 09 9000 - Paints and Coatings.

1.02 REFERENCES

A. CBC Chapter 22A.

B. American Institute of Steel Construction (AISC):

1. AISC – Steel Construction Manual:

a. AISC 360 Specifications for Structural Steel Buildings.

b. AISC Code of Standard Practice for Steel Buildings and Bridges.

c. RCSC Specification for Structural Joints Using High Strength Bolts.

2. AISC 341 - Seismic Provisions for Structural Steel Buildings.

3. AISC 358 - Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications.

C. ASTM International (ASTM):

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

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

3. ASTM A108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.

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

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

6. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, and Threaded Rod 60000 PSI Tensile Strength.

7. ASTM A435 - Standard Specification for Straight-Beam Ultrasonic Examination of Steel Plates.

8. ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.

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

10. ASTM A572 – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.

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

12. ASTM A673 - Standard Specification for Sampling Procedure for Impact Testing of Structural Steel.

13. ASTM A992 – Standard Specification for Structural Steel Shapes.

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

15. ASTM E23 - Standard Test Methods for Notched Bar Impact Testing of Metallic Materials.

16. ASTM E112 - Standard Test Methods for Determining Average Grain Size.

17. ASTM F3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.

18. ASTM F436 – Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.

19. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series.

20. ASTM F1554 – Standard Specification for Anchor Bolts, Steel, 36, 55 and 105-Ksi Yield Strength.

21. ASTM F1852 – Standard Specification for Twist Off Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

D. American Welding Society (AWS):

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

2. AWS D1.8 – Structural Welding Code – Seismic Supplement.

3. AWS A2.4 – Standard Symbols for Welding, Brazing, and Nondestructive Examination.

4. AWS B2.1 – Base Metal Grouping for Welding Procedure and Performance Qualification.

E. SSPC – Steel Structures Painting Council:

1. SSPC-SP2 - Hand Tool Cleaning.

2. SSPC-PA-1 - Shop, Field and Maintenance Coating of Metals.

1.03 REGULATORY REQUIREMENTS

A. Structural steel shall conform to CBC requirements, except that steel manufactured by acid Bessemer process is not permitted for structural purposes.

B. Sheet and strip steel other than those listed in CBC, if provided for structural purpose, shall comply with DSA requirements.

1.04 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings, including complete details and schedules for fabrication and shop assembly of members, and details, schedules, procedures and diagrams showing the sequence of erection. Fully detail minor connections and fastenings not shown or specified in the Contract Documents to meet required conditions using similar detailing as shown in the Contract Documents. Include a fully detailed, well controlled sequence and technique plan for shop and field welding that minimizes locked in stresses and distortion; submit sequence and technique plan for review by the ARCHITECT.

1. Include details of cuts, connections, camber, and holes in accordance with Figure 4.5 of AWS D1.1 or AISC Chapter J, weld position plan and other pertinent data. Indicate welds by standard AWS symbols, and show size, length and type of each weld.

2. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed for Work specified in other sections.

3. Erection and Bracing Plan and Erection Procedure: Submit an erection and framing plan, including columns, beams, and girders, signed and sealed by a Structural or Civil Engineer registered in the State of California in accordance with Title 8 California Code of Regulations, Section 1710, Structural Steel Erection. Maintain a copy at the Project site as required by the California Division of Industrial Safety.

4. Submit a list of steel items to be galvanized.

5. Include identification and details of Architecturally Exposed Structural Steel (AESS) members, if applicable.

B. Product Data: Submit copies of fabricator's specifications and installation instructions for the following products. Include laboratory test reports and other data required demonstrating compliance with these Specifications:

1. Structural steel, each type; including certified copies of mill reports covering chemical and physical properties.

2. Welding electrodes.

3. Welding gas.

4. Unfinished bolts and nuts.

5. Structural steel primer paint.

6. High-strength bolts, including nuts and washers.

C. Manufacturer's Mill Certificate: Submit, certifying that products meet or exceed specified requirements.

D. Mill Test Reports: Submit manufacturer's certificates, indicating structural yield and tensile strength, destructive and non-destructive test analysis.

E. Charpy-V-Notch (CVN) Impact Test: Submit certified copies of Charpy-V-Notch (CVN) Impact Test by the manufacturer for applicable steel members and components.

1. Charpy-V-Notch (CVN) Impact Test for Base Metal: Moment frame columns and girders subjected to Charpy-V-Notch impact test in accordance with "Seismic Provisions for Structural Steel Buildings", Part I, Section 6.3, as modified by Supplement 1.

2. Charpy-V-Notch test shall be performed by the manufacturer employing Test Frequency (P) in accordance with ASTM A673 and utilizing standard specimen sizes shown in Figure 6 of ASTM E23.

F. Submit certified copies of tests by manufacturer for fine grain practice. Structural steel base material, as described above, shall be manufactured to be fully killed and fine grained having grain size number 5 or better as determined by ASTM E112.

G. Welding Procedure Specifications (WPS): Submit weld procedures for all welding on project to OWNER's testing laboratory for approval. After approval by testing laboratory, submit to ARCHITECT for Record. Weld procedures shall be qualified as described in AWS D1.5, AISC 341 and AISC 358, as applicable. Weld procedures shall indicate joints details and tolerances, preheat and interpass temperature, post-heat treatment, single or multiple stringer passes, peening of stringer passes for groove welds except for the first and the last pass, electrode type and size, welding current, polarity and amperes and root treatment. The welding variables for each stringer pass shall be recorded and averaged; from these averages the weld heat input shall be calculated. Submit the manufacturer's product data sheet for all welding material used.

H. Welder's Certificates: Field welders shall be Project certified in accordance with AWS D1.1. Shop welders shall be Project certified for FCAW in accordance with AWS D1.1.

I. Test Reports: Submit reports of tests conducted on shop and field welded and bolted connections. Include data on type of test conducted and test results.

J. Welding Material Certification: Provide certificate that welding material complies with specifications. Submit to OWNER's testing laboratory.

1.05 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement, except as otherwise indicated:

1. American Institute of Steel Construction (AISC) "Code of Standard Practice for Steel Buildings and Bridges, modified as follows:

a. Replace "Structural Design Drawings" with "Contract Documents' throughout the document.

b. Paragraph 3.2 is hereby modified in its entirety as follows: "Contract Documents including but not limited to architectural, mechanical, plumbing, electrical, civil and kitchen design drawings and specifications shall be used as supplement to the structural plans to define configurations and construction information."

c. Delete Paragraph 3.3.

d. In Paragraph 4.4, delete the following sentence: "These drawings shall be returned to the Fabricator within 14 calendar days."

e. Delete Paragraph 4.4.1.(a) in its entirety.

f. Paragraph 4.4.2 is hereby modified in its entirety as follows: "No review action, implicit or explicit, shall be interpreted to authorize changes in the Contract Documents."

2. Perform welding in accordance with AWS Standards, AWS D1.1, and California Building Code Section 2204A.1 and approved Weld Procedure Specifications (WPS).

3. Welding for moment frames shall be in compliance with AISC 341 and AISC 358.

B. Shop fabrication shall be inspected in accordance with CBC.

C. Erect mock-up panel of fabricated structural steel meeting Architecturally Exposed Structural Steel (AESS) tolerances for exposed areas. Approval by ARCHITECT is required. Mock-up to remain for comparison but may not be left as part of the work.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store structural steel above grade on platforms, skids or other supports.

B. Protect steel from corrosion.

C. Store welding electrodes in accordance with AWS D 12.1.

D. Store other materials in a weather-tight and dry place until installed into the Work.

PART 2 - PRODUCTS

2.01 GENERAL

A. Stock Materials: Provide exact materials, sections, shapes, thickness, sizes, weights, and details of construction indicated on Drawings. Changes because of material stock or shop practices will be considered if net area of shape or section is not reduced thereby, if material and structural properties are at least equivalent, and if overall dimensions are not exceeded.

B. Shapes, bars, plates, tubes and pipes shall be made of materials with at least 16 percent recycled content if produced from Basic Oxygen Furnace (BOF) or at least 67 percent recycled content if produced from Electric Arc Furnace (EAF).

2.02 MATERIALS

A. Structural Steel: Wide flange shapes shall conform to ASTM A992 grade 50. Other steel shall conform to ASTM A36.

B. Unfinished Threaded Fasteners: ASTM A307, Grade A, regular low carbon bolts and nuts.

C. High-Strength Threaded Fasteners: ASTM F3125 or ASTM F959 quenched and tempered, steel bolts, nuts and washers.

D. Primers: Lead-free metal primer:

1. SSPC-Paint 20, Zinc-Rich Coating Inorganic and Organic.

2. SSPC-Paint 23, Latex Primer for Steel Surfaces.

E. Steel Pipe: ASTM A53, Type E or S, Grade B.

F. Structural Tubing:

1. Hot-formed, ASTM A501.

2. Cold-formed, ASTM A500, Grade B.

G. Galvanizing: ASTM A123.

H. Welding Electrodes: Provide electrodes recommended by manufacturer for seismic connections. Comply with AISC 341.

I. Shear stud connectors: ASTM A108, Grade 1015 forged steel, headed, uncoated, granular flux filled shear connector or anchor studs by Nelson Stud Welding Division, or equal.

J. Grout: ASTM C1107, non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at seven days; of consistency suitable for application and a 30 minute working time.

2.03 FABRICATION

A. Fabricate in accordance to AISC Code of Standard Practice for Steel Buildings and Bridges and AISC 360.

B. Cleaning and Straightening Materials: Materials being fabricated shall be thoroughly cleaned of scale and rust, and straightened before fabrication. Cleaning and straightening methods shall not damage material. After punching or fabrication of component parts of a member, twists or bends shall be removed before parts are assembled.

C. Cutting, Punching, Drilling and Tapping: Unless otherwise indicated or specified, structural steel fabricator shall perform the cutting, punching, drilling and tapping of Work so that Work of other trades will properly connect to steel Work.

D. Milling: Compression joints depending on contact bearing shall be furnished with bearing surfaces prepared to a common plane by milling.

E. Use of Burning Torch: Oxygen cutting of members shall be performed by machine. Gouges greater than 3/16 inch that remain from cutting shall be removed by grinding. Reentrant corners shall be shaped notch free to a radius of at least 1/2 inch. Gas cutting of holes for bolts or rivets is not permitted.

F. Galvanizing: After fabrication, items indicated or specified to be galvanized shall be galvanized per Section 05 5013, Hot-Dip Galvanizing.

G. Welding:

1. Type of steel furnished in welded structures shall provide chemical properties suitable for welding as determined by chemical analysis. Welds shall conform to the verification and inspection requirements of CBC Chapter 17A. Conform to AWS D1.1, and CBC Chapter 22A.

2. Materials and workmanship shall conform to the requirements specified herein and to CBC requirements, modified as follows:

a. No welded splices shall be permitted except those indicated on Drawings unless specifically reviewed by the ARCHITECT.

b. Drawings will designate joints in which it is important that welding sequence and technique be controlled to minimize shrinkage stresses and distortion.

3. Welding shall be performed in accordance with requirements of the AWS Structural Welding Code.

a. Welded Joint Details: Comply with AISC 341, AISC 358 and drawing details.

4. Architecturally Exposed Structural Steel: Verify that weld sizes, fabrication sequence, and equipment used for Architecturally Exposed Structural Steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds ½ inch and larger. Grind flush butt welds. Dress exposed welds.

5. Remove erection bolts on welded, Architecturally Exposed Structural Steel; fill holes with plug welds; and grind smooth at exposed surfaces.

H. Shop Finish:

1. Notify the Project Inspector when Work is ready to receive shop prime coat. Work shall be inspected by the Project Inspector before installation of primer.

2. Structural steel and fittings shall receive a coat of primer, except:

a. Surfaces that will be galvanized.

b. Surfaces that will be fireproofed.

c. Surfaces that will be field welded.

d. Surfaces in contact with concrete.

e. Surfaces high strength bolted.

3. The primer specified shall be spray applied, filling joints and corners and covering surfaces with a smooth unbroken film. The minimum dry film thickness of the primer shall be 2.0 mils.

I. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

J. Fabricate Architecturally Exposed Structural Steel with exposed surfaces smooth, square, and free of surfaces blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.

1. Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating and shop priming.

2. Comply with fabrication requirements, including tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for Architecturally Exposed Structural Steel.

K. Architecturally Exposed Structural Steel: use special care in unloading, handling and erecting the steel to avoid marking or distorting the steel members. Minimize damage to any shop paint when temporary braces or erection clips are used. Avoid unsightly surfaces upon removal. Grind smooth tack welds and holes filled with weld metal or body solder. Plan and execute all operations in such a manner that the close fit and neat appearance of the structure will not be impaired.

L. Reduced Beam Sections (RBS's): Fabrication of RBS's as defined in AISC 341 and AISC 358.

2.04 SHOP AND FIELD QUALITY CONTROL

A. A special inspector, approved by DSA to inspect the Work of this section, shall inspect high-strength bolted connections. OWNER will provide a DSA approved independent testing laboratory to perform tests and prepare test reports in accordance with CBC 1704A. The Project Inspector shall be responsible for monitoring the work of the special inspector and testing laboratories to ensure that the testing program is satisfactorily completed.

B. An AWS certified welding inspector (CWI), approved by DSA to inspect the Work of this section, shall inspect welded connections in accordance with CBC 1705A.2.5. The OWNER will provide a DSA approved independent testing laboratory to perform tests and prepare test reports. The Project Inspector shall be responsible for monitoring the work of the special inspector and testing laboratories to ensure that the testing program is satisfactorily completed.

C. The independent testing laboratory shall conduct and interpret test and state in each report whether test specimens comply with requirements, and specifically state any deviations there from.

D. Provide access to all places where structural steel Work is being fabricated or produced so required inspection and testing can be performed.

E. The independent testing laboratory may inspect or test structural steel at plant before shipment; however, ARCHITECT reserves the right at any time before Contract Completion to deem materials not in compliance with the specified requirements as defective Work.

F. Correct defects in structural Work when inspections and laboratory test reports indicate noncompliance with specified requirements. Perform additional tests as may be required to reconfirm noncompliance of original Work, and as may be required to show demonstrate compliance of corrected Work.

G. Inspection of Structural Tube Steel/Hollow Structural Sections (HSS): Structural tube steel members (round, square, rectangular), disregarding steel origin, will be inspected during shop fabrication per DSA Bulletin 07-03. Inspector will perform a visual examination of the seam weld area for visible discontinuities. When defects are suspected, non-destructive testing will be considered.

H. Welding: Inspect and test during fabrication and erection of structural steel assemblies as follows:

1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in the Work. Record Work required and performed to correct deficiencies.

2. Inspect welds. Welds shall be visually inspected before performing any non-destructive testing. Groove weld shall be inspected by ultrasonic or other approved non-destructive test methods. Testing shall be performed to AWS D1.1 Table 6.3 cyclically loaded non-tubular connections.

3. Ultrasonic testing shall be performed by a specially trained and qualified technician who shall operate the equipment, examine welds, and maintain a record of welds examined, defects found, and disposition of each defect. Repair and test defective welds.

4. Rate of Testing: Completed welds contained in joints and splices shall be tested 100 percent either by ultrasonic testing or by radiography.

5. Welds, when installed in column splices, shall be tested by either ultrasonic testing or radiography.

6. Base metal thicker than 1 ½-inch, when subjected to through-thickness weld shrinkage strains, shall be ultrasonically inspected by shear wave methods for discontinuities directly behind such welds. Tests shall be performed at least 48 hours after completed joint has cooled down to ambient air temperature.

7. Material discontinuities shall be reviewed based on the defect rating in accordance with the criteria of AWS D1.1 table 6.3 by the ARCHITECT and DSA.

8. Other method of non-destructive testing and inspection, for example, liquid dye penetrate testing, magnetic particle inspection or radiographic inspection may be performed on weld if required.

9. Lamellar Tearing: Lamellar-tearing resulting from welding is a crack (with zero tolerance) and shall be repaired in accordance with AWS D1.1.

10. Lamination: The rejection criteria shall be based on ASTM A435.

11. Where testing reveals lamination or conditions of lamellar tearing in base metal, the steel fabricator shall submit a proposed method of repair for review by the ARCHITECT. Test repaired areas as required.

12. Magnetic Particle Testing: Magnetic particle testing when required shall be provided in accordance with AWS D1.1 for procedure and technique. The standards of acceptance shall be in accordance with AWS D1.1 – Qualification.

I. Lamellar Tearing: Prior to welding plates 1 to 1-½ inch thick and greater and rolled shapes within the distance from 6 inches above the top of the joint to 6 inches below the bottom of the joint shall be checked by ultrasonic testing for laminations in base metal which may interfere with the inspection of the completed joint. Should these defects occur, members will be

reviewed by the ARCHITECT and DSA. Welding procedure specifications in paragraph 1.04.G specify welding practices to minimize lamellar tearing.

J. Prior Testing of Base Material: Test material before fabrication.

K. Lines and levels of erected steel shall be certified by a State of California licensed surveyor as set forth in related Division 01 section.

L. Welded studs shall be tested and inspected by the special inspector in accordance with requirements of AWS D1.1 – Stud Welding.

M. Record Drawings: After steel has been erected, correct or revise Shop Drawings and erection diagrams to correspond with reviewed changes performed in the field.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify governing dimensions and conditions of the Work before commencing erection Work.

1. Report discrepancies between drawings and field dimensions to ARCHITECT before commencing work.

2. Beginning of installation means erector accepts existing conditions and surfaces underlying or adjacent to work of this section.

B. Provide temporary shoring and bracing, and other support during performance of the Work. Remove after steel is in place and connected, and after cast-in-place concrete has reached its design strength.

C. Coordinate prime coat repair and application with requirements of Section 09 9000.

3.02 ERECTION

A. Install structural steel accurately in locations, to elevations indicated, and according to AISC specifications and CBC requirements.

B. Clean surfaces of base plates and bearing plates.

1. Install base and bearing plates for structural members on wedges, shims, or setting nuts as required.

2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims; cut off flush with edge of base or bearing plate before packing with grout.

C. Maintain erection tolerances of structural steel within AISC Code of Standard Practice for Steel Buildings and Bridges.

1. Architecturally Exposed Structural Steel members and components, plumbed, leveled and aligned to a tolerance not to exceed one-half the amount permitted for structural steel. CONTRACTOR to provide adjustable connections between Architecturally Exposed Structural Steel and the structural steel frame or the masonry or concrete supports, in order to provide the erector with means for adjustment.

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact after assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.

E. Do not permit thermal cutting during erection of structural steel.

F. Where indicated for field connections, provide standard bolts complying with ASTM A307.

G. Install high strength steel bolts at locations indicated. Assembly and installation shall be in accordance with CBC requirements and AISC specifications.

1. Allowable hole sizes: 1/16 inch larger than bolt size.

2. Use friction type connection with standard hardened steel circular, square or rectangular washer under bolt nut.

3. Thoroughly clean area under bolt head, nut and washer. Remove all paint, lacquer, oil or other coatings except organic zinc-rich paints in accordance with SSPC, SP-2.

4. Tighten bolts by power torque wrench or hand wrench until twist-off.

H. CONTRACTOR shall be responsible for correcting detailing and fabrication errors and for correct fitting of all members and components.

I. Erect structural steel plumb and level and to proper tolerances as set forth in the AISC Manual. Provide temporary bracing, supports or connections required for complete safety of structure until final permanent connections are installed.

J. Install column bases within a tolerance of 1/8 inch of detailed centerlines, level at proper elevations. Support bases on double nuts and solidly fill spaces under bases with cement grout.

K. Provide anchor bolts with templates and diagrams. CONTRACTOR shall be responsible for proper location and installation of bolts. Correct deficiencies and errors.

3.03 FITTING

A. Closely fit members, finished true to line and in precise position required to allow accurate erection and proper joining in the field.

B. Drilling to enlarge unfair holes will not be allowed. Allow only enough drifting during assembly to bring parts into position, but not enough to enlarge holes or distort the metal. Do not heat rolled sections, unless approved by ARCHITECT.

3.04 PUNCHING AND DRILLING

A. Punch material 1/16 inch larger than nominal diameter of bolt, wherever thickness of metal is equal to or less than the diameter of the bolt plus 1/8 inch.

B. Drill or sub-punch and ream where metal is equal to or more than the diameter of the bolt plus 1/8 inch. Make diameter for sub-punched and sub-drilled holes 1/16 inch larger than nominal diameter of bolt.

C. Precisely locate holes to ensure passage of bolt through assembled materials without drifting. Enlarge holes when necessary to receive bolts by reaming; flame cutting to enlarge holes is not acceptable. Structural Steel members with poorly matched holes will be rejected.

3.05 FINISHING

A. After erection, spots or surfaces where paint has been removed, damaged, or burned off, and field rivets, bolts, and other field connections shall be cleaned of dirt, oil, grease, and burned paint and furnished with a spot coat of the same primer installed during shop priming.

B. Touchup:

1. Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Install paint to exposed areas with the same material installed during shop painting. Install by brush or spray to provide a minimum dry film thickness of 1.5 mils.

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.

3.06 FIELD QUALITY CONTROL

A. OWNER will provide a special inspector and independent testing laboratory to perform field inspections and tests and to prepare test reports.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

3.07 CLEAN UP

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

3.08 PROTECTION

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

3.09 HANDLING

A. Both in shop and in the field, transport, handle and erect to prevent damage or overstressing of any component.

END OF SECTION

SECTION 05 5000

METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Metal fabrications:

1. Steel thresholds.

2. Steel ladders and ladder safety cages.

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

4. Steel Gates.

5. Gratings, frames and covers.

6. 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.

7. 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.

5. Section 05 1200: Structural Steel Framing.

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 075419

ADHERED THERMOPLASTIC (PVC) FELTBACK MEMBRANE ROOFING

PART 1 – GENERAL CONDITIONS

1.1 DESCRIPTION

A. Summary:

Install an adhered thermoplastic (PVC) feltback membrane roof system, including, but not limited to, primed gypsum cover board, PVC membrane flashings, PVC metal edge/fascia flashing, and other components to comprise a weathertight roof system. The roof system shall comply with the herein specified roofing manufacturer's standard written and detail requirements. Note: Sika Sarnafil products and system installation requirements have been utilized as the basis of design for this project.

B. System Description:

1. Remove and dispose of existing roof system; including all vertical flashings, pitch-pans and applicable sheet metal down to the structural plywood deck. All removal, hauling, and disposal procedures must be performed by a certified contractor and must meet or exceed all applicable Local and State requirements.

2. As applicable, coordinate with asbestos containing materials (ACM) abatement contractor for areas of the building subject to the work of this project. Staging of work shall be coordinated so that new roof material is installed within 24 hours of ACM abatement and roof removal. Under no circumstances shall ACM abatement and roof removal be done with the possible rain or other extreme weather expected or forecasted prior to the installation of the new roof system for any roof areas. Wood roof deck shall not be left exposed over weekends.

3. As identified by the Owner's Representative, remove and dispose of all non-usable roof vents, roof top equipment and applicable curbs. Repair and/or replace damaged or dry-rot plywood decking in accordance with Local building code requirements. Any required deck replacement shall be reimbursed at the rate included on the project bid form. All deck replacement shall be verified by EMUHSD prior to replacement.

4. Over the properly prepared plywood roof deck areas install a single layer of 1/4" thick pre-primed gypsum cover board with fiberglass mat facer. The cover board shall be installed directly over the plywood roof deck and shall be secured to the wood deck using Factory Mutual approved heavy duty fasteners and high field strength plates at a rate of 12 attachment plates and fasteners per 4'x8' board (one (1) every 2.667 square feet). Perimeter and corner attachment rates must be increased in accordance with Factory Mutual Data Sheets 1-28/29 requirements.

5. Install a layer of 60-mil thermoplastic (PVC) feltback membrane (EnergySmart White). The membrane shall be installed directly over the gypsum cover board and shall be adhered using VOC compliant, water-based adhesive. The membrane shall meet or exceed Cool Roof Rating Council (CRRC) requirements for Title 24 compliance.
6. Install new 24-Ga. “Kynar” coated GSM gutters to match existing (color and dimension) at all eave locations currently with gutters. The new gutters shall have a three-inch (3”) wide flange for attachment to the structural plywood deck using galvanized-steel angular ring-shank nails at a spacing of six-inch (6") on-center. The face dimension of gutter shall be one inch (1.0”) less the back dimension of gutter. One-inch (1”) wide, 16 Ga. GSM spacing straps are to be installed at 36” on-center. The straps are to provide a locking hook strip at face of gutter and shall be attached at the top-back edge of gutter using metal capped grommeted fasteners set in approved urethane sealant. The strap is to be configured in a “U” shape to provide clearance for the clad metal edge without modification (refer to Item #7 below). Gutter end-laps are to be two-inch (2”) minimum in direction of flow, sealed with approved urethane sealant and pre-painted pop-riveted to match color of gutter. Rivets are to be installed at two-inch (2”) on-center spacing. Note: The new gutters shall be fabricated with a four-inch (4”) long vertical down shot sleeve which shall be tight-fitted into the existing downspouts and internally sealed using Sikaflex 1a, or pre-approved equal one-part urethane sealant. Outside diameter of gutter down shot sleeve shall be 1/16 inch less inside diameter of the new downspout. New downspouts shall be three-inch by four-inch (3”x4”) fabricated with 22 gauge “Kynar” coated galvanized sheet metal, secured to the existing structure at the top and bottom as well as no greater than five-feet on-center (5’-0” o.c.). Gutter and Downspout color to be selected by Owner from Standard Colors only.

7. Install new PVC clad metal drip edge flashing perimeter edge. The new clad metal shall have a minimum four-inch (4") attachment flange and exceed the vertical face dimension of the existing sheet metal edge flashing by a minimum one-half inch and include a three-quarter inch (3/4") hemmed "kick" at bottom edge. The edge metal shall be secured to the wood substrate using approved fastener screws at a spacing of six-inch (6") on-center, staggered. Install a continuous 22-gauge galvanized sheet metal cleat (hook strip) and PVC membrane cover strip in accordance with the Roofing Manufacturer's standard written and detail requirements. Note: Install PVC clad metal covers at all vertical joints in accordance with Roofing Manufacturer’s standard requirements. Continuous metal cleat and cover plates are not required at gutter locations only.

8. Install adhered 60 mil PVC flashing membrane up and over the top of the perimeter parapet walls. Adhere new asphalt/oil resistant PVC flashing membrane to properly prepared parapet wall surface. At top outside edge of parapet wall, install new PVC clad metal edge flashing. The new clad metal shall have a minimum four-inch (4") attachment flange, four-inch (4.0") vertical face with three-quarter inch (3/4") hemmed "kick" at bottom edge. The edge metal shall be secured to the wood or concrete substrate using approved fasteners at a spacing of six-inch (6") on-center, staggered. Install a continuous metal cleat (hook strip) and PVC membrane cover-strip in accordance with the Roofing Manufacturer's standard written and detail requirements and as indicated on project drawings.

9. Install adhered 60 mil PVC flashing membrane at interior parapet wall. Remove existing GSM skirt flashings at existing reglet. Adhere new asphalt/oil resistant PVC flashing membrane over the properly prepared parapet wall surface carried up to the base of the existing reglet flashing. Terminate adhered membrane flashing with one-inch (1”) wide extruded aluminum attachment bar fastened 12” on-center maximum spacing fastened through top of membrane and approved sealant. Install new 24-gauge GSM skirt flashing matching existing profile and attachment method. All exposed fasteners shall include metal-capped grommitted heads.

10. Vent curbs without counter-flashing flange shall receive new adhered PVC flashing membrane extended up face of sheet metal curb a minimum of eight-inches (8”) and shall be terminated with a sealed Sarnareglet termination bar (Ref. Sarnafil Standard Detail 3-3). Top of completed reglet flashing shall receive Western Colloid #800 Elastic Cement Flashing and Polyester Fabric 3-Course Treatment.

11. Install new PVC membrane expansion-joint (EJ) flashing to replace existing EJ flashing. Install new G459 asphalt resistant flashing membrane over top of properly prepared existing parapet walls with membrane bellows between parapet walls and onto adjacent parapet wall. Membrane bellows shall be sized to accommodate compatible and compressible foam rod with diameter one-and-a-half times larger than the EJ gap. Place foam rod into membrane bellows and cover with flashing membrane carried past flashing membrane attachment on both sides of foam rod and hot-air weld providing watertight assembly.

12. At removable equipment curbs, install adhered 60-mil “asphalt-oil” resistant flashing membrane. Flashing membrane to be adhered to the properly prepared vertical substrate with approved flashing adhesive and carried up, over the top and down one and a half inches (1.5”) on inside of existing curb. Membrane shall be fastened 12” on center at inside of curb. Reinstall equipment to top of curb set in approved urethane sealant and secure to curb using increased diameter, metal-capped grommetted fasteners at a spacing of eight inches (8”) on-center. Where possible, use existing fastener holes when installing new fasteners. Seal any exposed fastener holes using approved urethane sealant.

13. At all non-removable equipment curbs, install adhered “asphalt-oil” resistant flashing membrane. Flashing membrane shall be adhered to properly prepared vertical substrate to the highest extent possible and terminated with 22-gauge GSM extender piece set in approved urethane sealant and fastened at 12” on center with metal-capped grommeted fasteners.

14. Replace all existing roof drain clamping rings, bolts and debris strainers with new matching components. Existing drain bowl and clamping ring flange shall be thoroughly cleaned prior to reinstalling PVC flashing membrane and sealant. All primary and overflow roof drains to receive new asphalt/oil resistant flashing membrane target with one full tube of manufacturer approved urethane sealant between the new flashing membrane and drain bowl receiver flange. Flashing membrane target shall be hot-air welded to roof membrane and installed in accordance with manufacturer’s “Clamping Ring Drain” flashing.

15. At all scupper locations, install new PVC clad metal inserts. The inserts shall extend continuous through the wall opening and shall terminate two-inches (2”) beyond the outside face of wall, using approved urethane sealant to seal gap at outside edge of insert. Scupper insert installation shall be in accordance with Manufacturer, SMACNA, and local building code requirements. Replace existing downspouts with new 24-gauge “Kynar” coated sheet metal leader head and downspout. New downspout shall be secured with new 1.0” wide GSM straps spaced no greater than 5.0’ on-center, at the top, bottom and at the lower portion of each miter. Straps shall be etched, primed and two coats of commercial grade exterior acrylic latex paint. Color of paint to be selected by Architect.

16. All open (soil, vent, etc.) pipes shall be flashed utilizing "Vent Stack" detail with PVC membrane cap as indicated. Note: The use of clamps for membrane termination will not be accepted at open (non-connected) pipes.

17. All connected (conduit, gas, etc.) pipes will be flashed utilizing PVC membrane pipe flashing detail with additional 60 mil fiberglass reinforced PVC membrane storm collar set in approved sealant and clamped in place with stainless steel pipe clamp covering the primary pipe flashing.

18. All “Hot-Pipe” penetrations shall be flashed in accordance with the Roofing Manufacturer’s temperature separation requirements. An acceptable metal sleeve, insulation, and rain collar are required to separate PVC flashing membrane from hot pipe, minimum two-inch (2”) separation. Use high temperature sealant at rain collar and hot pipe locations.

19. Reseal existing equipment anchors on sheet metal covered equipment platforms. Remove existing anchors, install approved urethane caulking/sealant in pilot hole and install new threaded anchors (oversize when possible). Seal top of anchors with approved sealant.

20. At all inside and outside corner locations, install prefabricated membrane flashings only.

21. Remove and replace existing sealant at through wall sheet metal ducting. Properly prepared existing concrete and sheet metal surfaces to receive new Sikaflex-1a sealant. Seal between concrete and sheet metal flanges. All exposed sealants shall be tooled to shed water. Install 3-course Western Colloid #800 Elastic Cement and Polyester Fabric over new sealant joint transition from the sheet metal flashing to concrete wall surface.

22. At all rooftop electrical conduit, condensate piping, gas piping, etc., install new, prefabricated thermoplastic pipe supports as manufactured by Miro Industries, or pre-approved equal. The pipe supports shall be positioned at a maximum spacing as required allowing for continuous four inch (4”) clearance above the finished roof surface. Properly secure the conduit/piping to the pipe support using approved metal straps.

23. Install 96-mil PVC walkway tread (Light Grey color) at roof access points and serviceable sides of regularly maintained HVAC rooftop equipment. The walkway tread shall be installed in accordance with the Roofing Manufacturer’s standard written and detail requirements.

24. Perform all flashing and detail work in strict accordance with the roofing manufacturer's standard written and detail requirements (as indicated within the project detail drawings and/or specification requirements, those specific project requirements shall supersede any corresponding minimum/standard requirements).

    A. Work Included:

    The work includes but is not necessarily limited to the installation of:

    1. Existing Roof Removal
    2. Substrate Preparation.
    3. Gypsum Cover Board.
    4. Cover Board Attachment Plates and Fasteners
    5. Flashing Membrane Adhesive.
    6. Roof Membrane Adhesive.
    7. Membrane Attachment Bars & Fasteners.
    8. Thermoplastic (PVC) Feltback Roof Membrane.
    9. Thermoplastic (PVC) Flashing Membrane.
    10. Metal Flashings.
    11. Sealants.
    12. Roof Drains Replacement Parts.
    13. Equipment Access/Walkway Tread.
    14. Prefabricated Pipe Supports (Miro Industries).

1.2 QUALITY ASSURANCE

A. Pre-Roofing Conference and Inspection: After approval of submittals but prior to beginning installation of Work of this Section, the Owner's Representative shall hold a meeting at the site attended by the Roofing Applicator, Sheet Metal, Painting, and related Subcontractors, and the Roofing Material Manufacturer to describe in detail the roof system(s) to be installed and to establish agreement, coordination, and responsibilities among the involved trades.

B. The roofing system shall be applied only by an Applicator authorized by the specified Roofing Manufacturer prior to bid. The Applicator shall have a minimum of five (5) years documented experience with the Roofing Manufacturer. The Owner's Representative reserves the right to request a list of reference projects to verify Applicator's performance/work history. All references must be of similar size and scope, and must be within 100 miles of this project.

C. The Roofing Manufacturer shall have directly produced the specified field and flashing membranes for the number of years equal to, or greater than that of the warranty term (20 years). The membrane shall have also maintained a consistent base formulation for the same number of years.

D. The Roofing Manufacturer shall have a *Sustainable Product Certification* conforming to the requirements of *NSF/ANSI 347 – Sustainability Assessment for Single Ply Roofing Membranes*. Minimum certification level established for this project is: *Platinum*.

E. Use only a Manufacturer who has initiated a post-consumer recycling program and can demonstrate a minimum of five projects where the existing PVC membrane has been removed and recycled into new roofing membrane or PVC components.

F. Membrane Manufacturer must have *Recycled Content Certification* from UL (Underwriters Laboratories) Environment.

G. Membrane thickness stated in this document refers to waterproofing membrane PVC polymer thickness. Polyester felt backing is always in addition to the required membrane thickness and is measured in weight per square yard. The required weight for felt backing is nine ounces per square yard (9-Oz./Yd2). This is a non-negotiable minimum requirement.

H. Unreinforced or polyester reinforced membranes are prohibited.

I. Re-labeled / re-packaged ("Private-labeled") primary and flashing membranes will not be accepted.

J. Membrane Manufacturer must have ISO 14001 Certification and a Responsible Care Program in-place with current good standing status.

K. Membrane Manufacturer must not require the use of membrane cut edge sealant at any location. This is a maintenance item that the Owner does not accept.

L. The Manufacturer shall provide interim and final roof inspection from a directly employed dedicated team of experienced inspectors. Sales personnel may not be used for onsite inspection of installations.

1.3 PRE-INSTALLATION MEETING

A. Arrange for a Pre-Installation Meeting between the Applicator, Owner's Representative, Roofing Manufacturer's Representative, and related trades to be held at least two (2) weeks prior to the beginning of roof system installation.

B. Review contract documents, manufacturer's instructions, project conditions, and proposed methods and procedures related to installation.

1. Identify conditions that would be detrimental to proper installation.

2. Review special details, corner conditions, drainage patterns, penetrations and similar conditions of adjacent construction that will affect or impact surface preparation and installation operations.

3. Review substrates and surfaces to receive materials in order to verify compliance with specified requirements, and with manufacturer's substrate tolerance recommendations and surface preparation requirements, including flatness, levelness, damage and imperfections, and quality of attachment to structure.

4. Review limitations of floor and roof decks for structural loading both during and after installation.

C. Review governing regulations and specified requirements for certificates, inspection, reports and closeout submittals.

D. Review sequence of installation, finalize construction schedule, and verify availability of materials, installer's personnel, equipment and facilities necessary to make progress and avoid delays.

E. Review temporary protection procedures required to be followed to provide protection of stored and installed products and accessories both during and after installation.

F. Owner’s Representative shall record significant meeting discussions, agreements and disagreements, including required corrective measures and actions to be taken before work begins. Distribute copy of minutes to Owner's Authorized Representative, to each party present, and to parties who should have been present no later than 3 business days following the meeting.

G. Do not proceed with installation until all attendees, including all parties who should have been present, provide written acknowledgement of receipt and agreement to the conditions and requirements as described in the "Meeting Minutes". If disagreements cannot be successfully resolved, initiate necessary actions to remove impediments to execution of the Work and reconvene meeting at earliest available date to resolve outstanding disagreements.

1.4 PERFORMANCE REQUIREMENTS

A General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

C. The applicator shall submit evidence that the proposed roof system meets local building code requirements and has been tested and approved or listed by the following test organizations.

1. ASCE/SEI 7 and SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems".
   a. Corner Design Uplift Pressure: 180 lbs. / Ft2
   b. Perimeter Design Uplift Pressure: 120 lbs. / Ft2
   c. Field-of-Roof Design Uplift Pressure: 90 lbs. / Ft2
   d. Safety Factor 1.5

2. Underwriters Laboratories, Inc.: Class A assembly

D. Energy Performance:

Low-Slope Roofs: Provide roof system with an initial Solar Reflectance Index (SRI) of not less than 100 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency. Roof membrane (not post installation applied finish) shall comply with current California Title 24 Part 6 minimum 3-year aged solar reflectance of 0.63 and a minimum thermal emittance of 0.75 requirements.

1.5 SUBMITTALS:

A. Submittals upon award (utilizing the base specified system: Sika Sarnafil)

1. A list of each primary component to be used in the roof system and the Manufacturer's current literature for each component.
2. Shop drawing of any deviations from specified details with manufacturer’s approval for consideration by the Architect and Owner.
3. Tapered Roof Insulation Layout.
4. Sample copy of Roofing Manufacturer's warranty.
5. Sample copy of Contractor's warranty.
6. Letter from Roofing Manufacturer confirming that the Contractor is an authorized applicator of the specified roof system.

B. Submittals of equals (prior to bid)

Submit proposed equals to be considered for use on this project no less than fourteen (14) days prior to bid date. Proposed roof systems which have been reviewed and accepted will be listed in an addendum prior to bid date; only then will roof systems be accepted at bidding. All below referenced letters must be original, wet-ink signed by the proposed Roofing Manufacturer's Technical Director/Manager. Submittals shall include the following:

1. Two 12-inch x 12-inch membrane samples and two samples of each component to be used in the roofing system.

2. Manufacturer's specification matching the herein specified requirements for all Sub-Sections as described. The Manufacturer shall also provide written confirmation that all detail and flashing conditions will be installed in strict accordance with the OWNER'S Standards as indicated within this specification and otherwise stated within the Contract Documents. Acceptance of any other, non-specified manufacturer's material(s) will not be deemed as acceptance for use of said manufacturer's minimum detail and/or installation requirements.
3. Letter from the proposed Roofing Manufacturer stating that the Manufacturer has a minimum of 20 years consistent experience in directly producing the proposed roof system. The letter shall also state that the proposed Manufacturer's membrane has maintained a consistent formulation for a minimum of 20 years.
4. Letter from the Cool Roof Rating Council (CRRC) stating that the proposed PVC membrane demonstrates the required Solar Reflectance Index requirements as stated in Section 1.4 D above. Submit listing as an approved product by the CRRC.
5. Letter from proposed Roofing Manufacturer describing the specified certified polymer thickness program. Included shall be a sample copy of the proposed Manufacture's certificate for polymer thickness as specified.
6. Letter from the proposed Roofing Manufacturer confirming that it has been engaged in a post-consumer recycling program in compliance with the requirements as started in Section 1.2 E above. The proposed Roofing Manufacturer shall provide written proof that its post-consumer recycling program has achieved *UL Environmental* certification.
7. Complete list of material physical and mechanical properties for each membrane and component including; weights and thicknesses; ultimate elongation; puncture resistance; seam peel strength; breaking strength; tear strength; dimensional stability; low temperature bend; and post-consumer recycle content.
8 Sample copy of specified warranties.
   a. Manufacturer's 20-Year System Warranty (with no ponding/standing water exclusions).
   b. Contractor's Two (2) Year Warranty
9. Letter from the proposed Roofing Manufacturer confirming that the Contractor is an authorized applicator of the proposed roof system per the requirements of Section 1.2 B listed above.

1.6 PRODUCT DELIVERY, STORAGE, and HANDLING:

A. All products delivered to the job-site shall be in the original unopened containers or wrappings bearing all seals and approvals. Handle all materials to prevent damage. Place all materials on pallets and fully protect from moisture.

1.7 JOB CONDITIONS

A. PVC materials may be installed under certain adverse weather conditions but only after consultation with the Roofing Manufacturer, as installation time and system integrity may be affected.

B. Uninterrupted waterstops shall be installed at the end of each day's work and shall be completely removed before proceeding with the next day's work.

C. The Applicator shall conduct adhesion tests in accordance with the latest revision of the SPRI/ANSI pull test requirements to verify condition of deck and to confirm expected pull test values. Pull tests shall be performed a minimum of one (1) week prior to job start.

D. Arrange work sequence to avoid use of newly constructed roofing as a walking surface or for equipment movement and storage. Where such access is absolutely required, the General Contractor shall provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas by sub-trades. A substantial protection layer consisting of 1/2" plywood over polyester felt or 1/2" plywood over insulation board shall be provided for all new and existing roof areas which receive rooftop traffic by sub-trades during construction.

E. The Applicator shall verify that all roof drain lines are functioning correctly (not clogged or blocked) before starting work. Applicator shall report any such blockages to the Owner's Representative for corrective action prior to beginning roof system installation.

1.8 BIDDING REQUIREMENTS

A. Bidders Responsibility

Bidders must have held their Roofing Contractors License (C39) for a minimum of five (5) years, with a continuous "Good-Standing" status to qualify to bid on this project. Any discrepancy between measurements and conditions listed within this specification, roof plans, and details, and those actually incurred on the job will be the responsibility of the Applicator.

1.9 WARRANTIES

A. Roofing Manufacturer's 20-Year Full System Warranty: 60 MPH Windspeed Coverage

Upon successful completion of all the work to the Roofing Manufacturer's and Owner's Representative's satisfaction, the 20 Year Full System Warranty shall be issued. The System warranty shall provide Non-Penal Sum (replacement cost) coverage for the roof membrane, all associated accessories that comprise the roof system, and all contractor labor for 20 years. The warranty shall be non-prorated, and shall not exclude ponding/standing water and no time limit shall be assigned for any such ponding/standing water during the warranty term. The warranty shall not exclude regular foot traffic upon the roof membrane surface. Warranty shall not obligate the Owner to perform manufacturer defined maintenance work as a condition of continued warranty coverage.

B. Roofing Applicator/Contractor Two (2) Year Warranty

The Applicator/Contractor shall supply the Owner with a separate two-year workmanship warranty. In the event any work related to roofing, flashing, or metal is found to be within the Applicator/Contractor warranty term, defective or otherwise not in accordance with the Contract Documents, the Applicator/Contractor shall repair that defect at no cost to the Owner.

C. "Early Bird" warranties are not to be issued as they will not be accepted by the Owner. The above specified Warranty will be issued only upon acceptance by the Roofing Manufacturer's Technical Department and the Owner's Representative's final approval.

PART 2 - PRODUCTS

2.1 GENERAL

A. The components of the adhered PVC feltback membrane roof system are to be products of Sika Sarnafil and/or products utilized by Sika Sarnafil to designate type, quality, and performance standards for this project.

B. Substitutions: Upon pre-approval in accordance with Section 1.5 B above.

2.2 MANUFACTURER AND MEMBRANE

A. Sika Sarnafil:G410 60-mil Guaranteed Thickness PVC with 9 oz. integral felt backing (Western Region Contact:(909) 942-0079)

B. G410-60: Fiberglass reinforced membrane with an integral lacquer coating to repel dirt and sustain long-term solar reflectivity.

C. Membrane shall be manufactured by Extrusion/Spread Coating process only, producing a monolithic membrane with fully encapsulated fiberglass reinforcement layer and a minimum of 27-mils of "weathering" polymer above the center of the fiberglass reinforcement layer.

E. Membrane shall conform to ASTM D4434 (latest revision), "Standard for Polyvinyl Chloride Sheet Roofing". Classification: Type II Grade I (fiberglass reinforcement).

F. Roofing Manufacturer shall certify in writing that the product supplied for this project has a minimum polymer thickness of 60 mils. ASTM +/- tolerance for membrane thickness is not accepted.

G. Membrane shall comply with California Building Code (CBC) Title 24, Section 118 requirements for solar reflectivity and emissivity. Manufacturer and membrane shall be listed in the Cool Roof Rating Council (CRRC) product listing as outlined by the Department of Energy (DOE) and the Environmental Protection Agency (EPA).

H. As manufactured, membrane shall conform to the following physical properties:

1. Color to be "EnergySmart" White.

2. Thickness to be 60-mil (1.50 mm).

Property	ASTM Test Method	Minimum Physical Properties Requirements
Overall Thickness, mil	D751	60
Thickness Over Scrim, mil	--	27
Reinforcing Material	--	Fiberglass
Felt Weight, oz/yd2 (feltback membrane only)	--	9
Breaking Strength, lbf/in (N)	D751	80 (356)
Elongation at Break, % M.D.(1) & C.M.D. (1)	D751	250 & 220
Seam Strength, % of original (2)	D751	Pass
Retention of Properties After Heat Aging	D3045	--
Breaking Strength, % of original	D751	Pass
Elongation, % of original	D751	Pass
Tearing Resistance, lbf (N)	D1004	17.5 (78)
Low Temperature Bend, -40F(-40C)	D2136	Pass
Accelerated Weather Test (Florescent Light UV Exposure),Hours	G154	10,000
Cracking (7x magnification)		None
Discoloration (by observation)		Negligible
Crazing (7x magnification)		None
Linear Dimensional Change, %	D1204	-0.02
Weight Change After Immersion in Water, %	D570	1.9
Static Puncture Resistance, lbf (kg)	D5602	Pass
Dynamic Puncture Resistance, ft-lbf (J)	D5635	Pass
Recycle Content	9% Pre-consume, 1% Post-consumer	

*Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions, and curing conditions.
(1) M.D. = Machine Direction, C.M.D. = Cross Machine Direction
(2) Failure occurs through membrane rupture not seam failure.

2.3 FLASHING MATERIALS

A. Wall/Curb Flashing

1. G410 Membrane: Fiberglass reinforced membrane adhered to approved substrate using Stabond adhesive. Consult Sarnafil Product Data Sheets for additional information.

2. S327 Membrane: Polyester reinforced membrane for mechanically-attached flashings to approved substrate using Sarnastop.
3. Sarnaclad: PVC-coated, heat-weldable sheet metal. Sarnaclad is a 24 gauge, G90 galvanized metal sheet with a 20 mil (1 mm) unsupported PVC membrane laminated on one side. Consult Sarnafil Product Data Sheet for additional information.

B. Perimeter Flashing:

1. PVC Clad Metal Edge: PVC coated, heat-weldable sheet metal with continuous 22-gauge galvanized metal cleat. Sarnaclad is a 24 gauge, G90 galvanized metal sheet with a 20 mil (1 mm) unsupported PVC membrane laminated on one side.

C. Miscellaneous Flashing;

1. Aluminum Membrane Attachment Bar (Sarnastop)
2. Termination Reglet (Sarnareglet)
3. Pipe Boots (Sarnastack)
4. Universal Corners (Sarnacorners)
5. Flashing Membrane Adhesive (Stabond)

2.4 COVER BOARD / TAPERED ROOF INSULATION CRICKETS

A. DensDeck Prime (or pre-approved equal): Fire-tested, gypsum cover board with pre-coated fiberglass mat facers. Manufactured with Eonic Technology to include the following physical properties characteristics:

1. ASTM C 1177 (Consensus Standard).
2. Board Size: 1/4" x 4' x 8'.
3. Weight (nominal): 1.2 Lbs./Ft2.
4. Surfacing: Primed Fiberglass Mat.
5. Flexural Strength, Parallel (ASTM C473): 100 lbf, minimum.
6. Flute Span (ASTM E661): 2-5/8” inches.
7. Permeance (ASTM E96): Greater than 17 perms.
8. R-Value (ASTM C518): 0.28.
9. Water Absorption (ASTM C473): Less than 5 percent of weight.
10. Surface Water Absorption (ASTM C473): Nominal 1.0 grams.
11. Compressive Strength (Applicable Sections of ASTM C472): Nominal 900 pounds per square inch.
12. Flame Spread/ Smoke Development (ASTM E84): Not more than 0 Flame Spread, 0 Smoke Development
13. Combustibility (ASTM E136): Noncombustible
14. Fire resistance rating (UL 790 and ASTM E108): Class A
15. Mold Resistance (ASTM D3273): Scored a 10

B. Tapered Insulation (Crickets Only): 1/2" min. x 4’ x 4’ sloped rigid roof insulation panels composed of polyisocyanurate closed-cell foam core with coated glass facer laminated to both sides. Manufactured to meet the following requirements:

1. ASTM C1289-11, Type II, Class 2, Grade 2 (20 psi)
2. Zero Ozone Depletion Potential (ODP) from blowing agent (HCFC-free).
3. Long-Term Thermal Resistance (LTTR) R-Value based on ASTM 1303-11 and/or CAN/ULC-S770-09: Regardless of published values.
4. Facer Type: Premium performance coated glass facer.
5. Board Size: 1/2" min. x 4’ x 4’.
6. Tapered Insulation Slope: 1/2" per foot (double the primary slope) or as indicated otherwise.

2.5 ATTACHMENT COMPONENTS

A. Membrane Adhesive

1. V.O.C. Compliant Water Based Adhesive (Sarnacol 2121 Adhesive): Water-based adhesive used to attach the membrane to the horizontal or near-horizontal substrate. Consult Product Data Sheets for additional information.

B. Sarnafastener #12: Corrosion-resistant #12 fastener used with attachment plate to attach cover board to wood roof deck.

C. Sarnaplate: Used with Sarnafasteners to attach cover board to roof deck. Sarnaplate is a 3 inch square or round, 26 gauge stamping of SAE 1010 steel with an AZ 55 Galvalume coating.

D. Flashing Membrane Adhesive (Stabond Adhesive): Solvent-based reactivating-type adhesive used to attach the membrane to the flashing substrate. Consult Product Data Sheets for additional information.

E. Sarnafastener-XP: Corrosion-resistant #15 fastener used with membrane attachment bar to attach membrane to wood roof deck or curbed penetrations.

F. Membrane Attachment Bar (Sarnastop): One (1) inch wide, pre-punched aluminum membrane attachment bar. Used to attach PVC membrane at all perimeter and base-angle transitions. Consult Sarnafil Product Data Sheet for additional information.

2.6 WALKWAY PROTECTION

A. Equipment Access/Walkway Tread (Sikaplan Walkway-20): Polyester reinforced, 79 mil/1.97 mm), weldable membrane with surface embossment. Used as a protection layer from rooftop traffic. Sikaplan Walkway-20 is supplied in rolls of 39.3 inches wide and 32.67 feet long. Consult Sarnafil Product Data Sheet for additional information.

2.7 MISCELLANEOUS ACCESSORIES

A. Sealing Tape: Compressible foam with pressure-sensitive adhesive on one side. Used with metal flashings as a preventive measure against air and windblown moisture entry.

B. Sarnasolv: Solvent cleaner used for the general cleaning of scuff marks, etc., from the Membrane surface.

2.8 SEALANTS

A. Depending on substrates, the following sealants are options for temporary overnight tie-ins:

1. Multiple layers of roofing cement and felt.
2. Mechanical attachment with rigid bars and compressed sealant.

2.9 EQUIPMENT / PIPING SUPPORTS

A. Miro Industries, Inc.: Pillow Block or Strut Series piping supports installed over protection membrane to support roof top equipment or piping and protect new PVC Roof System.

2.10 MISCELLANEOUS FASTENERS AND ANCHORS:

A. All fasteners, anchors, nails, straps, bars, etc. shall be post-galvanized steel, aluminum or stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION:

Report to Owner in writing all conditions that interfere with or prevent correct installation of work of this Section.

3.2 PRE-INSTALLATION MEETING

A. Refer to Section 1.3 of this specification for meeting agenda requirements.

Discuss the following additional project aspects:

1. Safety
2. Set up
3. Construction schedule
4. Contract conditions
5. Coordination of the work

6. Structural Loading Limitations/Requirements
7. Review of Deck and/or Substrate Conditions

3.3 SUBSTRATE CONDITION

A. Applicator shall be responsible for acceptance or provision of proper substrate to receive new roofing materials.

B. Applicator shall verify that the work done under related sections meets the following conditions:

1. Roof drains and/or scuppers have been installed properly.
2. Roof curbs, equipment supports, vents and other roof penetrations are properly secured and prepared to receive new roofing materials.
3. All surfaces are smooth and free of dirt, debris and incompatible materials.
4. All roof surfaces shall be free of water.

3.4 SUBSTRATE PREPARATION

The roof deck and existing roof construction must be structurally sound to provide support for the new roof system. The Applicator shall load materials on the rooftop in such a manner to eliminate risk of deck overload due to concentrated weight. The Owner's Representative shall ensure that the roof deck is secured to the structural framing according to local building code and in such a manner as to resist all anticipated wind loads in that location.

3.5 SUBSTRATE INSPECTION

A. A dry, clean and smooth substrate shall be prepared to receive the new PVC membrane roof system.

B. The Applicator shall inspect the substrate for defects such as excessive surface roughness, contamination, structural inadequacy, or any other condition that will adversely affect the quality of work.

C. The substrate shall be clean, smooth, dry, free of flaws, sharp edges, loose and foreign material, oil and grease. Roofing shall not start until all defects have been corrected.

D. All roof surfaces shall be free of water.

E. PVC membrane shall be applied over compatible and accepted substrates only.

3.6 COVER BOARD INSTALLATION

A. Cover board shall be fastened to the wood deck with manufacturer approved plate and heavy-duty fastener at a rate according to ASCE/SEI 7-16 and Factory Mutual Class 1-90 and the Roofing Manufacturer's requirements for attachment rates and patterns.

3.7 INSTALLATION OF PVC ROOF MEMBRANE:

A. General

1. Roof membrane is to be adhered according to the Roofing Manufacturer and Factory Mutual's requirements.
2. Membrane overlaps shall be shingled with the flow of water where possible.
3. Lay membrane rolls perpendicular to the direction of the roof slope.
4. Tack welding of membrane full or half-width rolls for purposes of temporary restraint during installation on windy days is not permitted. Consult Roofing Manufacturer's Technical Department for further information.
5. Hot-air weld overlaps according to roofing manufacturer's Take test cuts at least 3 times per day.
6. Membrane flashings shall extend 2-1/2 inches past the membrane attachment bar and shall be hot-air welded to the field membrane as required.

3.8 HOT-AIR WELDING OF SEAM OVERLAPS :

A. All field seams shall be hot-air welded using robotic welding equipment only (no hand-held welders). Seam overlaps should be 3 inches wide except for certain details.

3.9 MEMBRANE FLASHINGS:

A. All flashings shall be installed concurrently with the roof membrane as the job progresses.

B. Stabond Adhesive for Membrane Flashings: Stabond adhesive shall be applied according to instruction found on the Product Data Sheets. The bonded sheet shall be pressed firmly in place with a hand roller.

C. All flashings shall extend a minimum of eight (8) inches above roofing level unless otherwise accepted in writing. No bitumen shall be in contact with the PVC membrane. All flashing membranes shall be mechanically fastened along the counter-flashed top edge with Sarnastop or Sarnareglet at six inches (6") on-center.

3.10 PVC CLAD METAL BASE FLASHINGS:

A. All metal flashings shall be fastened into metal/wood stud nailers or metal stud backing plates with manufacturer approved fasteners. Fasteners shall penetrate the nailer a minimum of 1 inch. Metal shall be installed to provide adequate resistance to bending and allow for normal thermal expansion and contraction.

B. Adjacent sheets of PVC clad metal shall be spaced 1/4 inch apart. The joint shall be covered with two (2) inch wide aluminum tape. A four (4) inch minimum wide strip of PVC flashing membrane shall be hot-air welded over the joint.

3.11 METAL FLASHINGS

A. Metal details, fabrication practices and installation methods shall conform to the applicable requirements of the following:

1. Factory Mutual Loss Prevention Data Sheet 1-49 (latest issue).
2. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) – latest issue.

B. Metal joints shall be watertight. Metal flashings shall be securely fastened into metal stud backing plates. Fasteners shall penetrate the metal studs. Counter flashings shall overlap base flashings at least four (4) inches. Hook strips shall extend past metal studs and shall be securely sealed from air entry.

3.12 PIPE SUPPORT

A. Install Miro Industries Pillow Block or Strut Series supports in accordance with International Mechanical Code – Section 305 Piping Support with maximum allowable horizontal spacing at 4 to 10 feet depending on pipe type and size

3.13 WALKWAY INSTALLATION

A. Sikaplan Walkway-20: Apply a continuous coat of Stabond adhesive to the deck sheet and the back of Walkway in accordance with Sika Sarnafil's Technical requirements and press Walkway into place with a water-filled, foam-covered roller. Hot-air weld the entire perimeter of the Walkway to the field membrane. Do not apply adhesive to perimeter of walkway being hot-air welded.

3.14 TEMPORARY CUT-OFF

A. Flashings shall be installed concurrently with the roof membrane in order to maintain a watertight condition as the work progresses:

1. Temporary waterstops shall be constructed to provide a 100% watertight seal.
2. Stagger of the cover board joints shall be made even by installing partial panels of the cover board.

3. New membrane shall be carried into the waterstop sealant.
4. Waterstop shall be sealed to the deck and/or substrate so that water will not be allowed to travel under the new or existing roofing.
5. When work resumes, the contaminated membrane shall be cut out.
6. Sealant, contaminated membrane, insulation fillers, etc. shall be removed from work area and properly disposed of offsite. These materials shall not be used in new work.

B. If inclement weather occurs while temporary waterstop is in place, Applicator shall provide the labor necessary to monitor the situation to maintain a watertight condition.

C. If water is allowed to enter under the newly-completed roofing, the affected area shall be removed and replaced at the Applicator's expense.

3.15 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Owner’s Representative.

B Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

3.16 PROTECTION AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, provide written report, with copies to the Owner’s Representative.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Contract Completion and according to warranty requirements.

END OF SECTION

SECTION 07 6000

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sheet metal flashings in connection with roofing.
2. Reglet and counter flashing assemblies.
3. Miscellaneous metal flashing and counter flashing as required, except where provided under Divisions 22, Plumbing, 23, HVAC, or 26, Electrical.
4. Coping caps.
5. Gravel stops and metal edging.
6. Gutters and downspouts SEE 07 5419 ADHERED THERMOPLASTIC(PVC) MEMBRANE ROOFING .
7. Splash pans where downspouts empty onto roofing.
8. Conductor heads.
9. Drip flashings.
10. Sheet metal covering at outside storage units.
11. Sheet metal wall coverings.
12. Roof pipe flashings.
13. Roof expansion joint covers.
14. 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 05 3000 – Metal Decking.
3. Section 07 1800 – Traffic Coating.
4. Section 07 2200 - Roof and Deck Insulation.
5. Section 07 3113 - Fiberglass Reinforced Asphalt Shingles.
6. Section 07 3213 - Clay Roof Tiles.
7. Section 07 4000 - Roofing and Siding Panels.
8. Section 07 5419.13 - Polyvinyl-Chloride Roofing (Mechanically Attached For Existing Facilities).

9. Section 07 7100 - Roof Specialties.
10. Section 07 9200 - Joint Sealants.
11. Section 08 3313 - Coiling Counter Doors.
12. Section 08 6323 - Metal-Framed Skylights.
13. Section 09 2423 - Cement Plaster and Metal Lath
14. Division 22 –- Plumbing.
15. Division 23 - HVAC.
16. 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.

1. As-Milled Finish: **[Mill] [One-side bright mill] [Standard one-side bright] [Standard two-side bright].**

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. 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.

C. 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.

D. 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.

E. 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.

F. 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.

G. 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.

H. 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.

I. 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 7100

ROOF SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Roof hatches.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 05 5000 – Metal Fabrications.

3. Section 06 1000 - Rough Carpentry.

4. Section 07 5419 - Adhered Thermoplastic (PVC) Feltback Membrane Roofing

5. Section 07 6000 - Flashing and Sheet Metal.

1.02 SUBMITTALS

A. Shop Drawings: Submit for fabricated sheet metal indicating details, methods of joining, anchoring and fastening, thicknesses and gauges of metals, concealed reinforcement, sections, and profiles.

B. Samples: Submit Samples for materials or assemblies as requested. Provide finish Samples of exposed items.

C. Product Data: Submit brochures of manufactured items.

D. Installation Instructions: Provide manufacturer's recommended installation methods and instructions for each item. Instructions shall be prepared to indicate exact conditions of roofing, structure and adjoining construction.

1.03 QUALITY ASSURANCE

A. Drawings and requirements specified govern. Provide the Work in accordance with the Architectural Sheet Metal Manual published by SMACNA for conditions not indicated or specified and for general fabrication of sheet metal items.

B. Qualifications of Installer: Minimum 5 years experience in successfully installing the same or similar sheet metal specialties on roofing systems similar to the roofing systems specified.

C. Coordinate opening sizes and installation with roofing and related Work to ensure fit and installation.

D. 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. Protect roof specialties and accessories by storing above grade on required skids or supports. Protect from physical damage and do not install bent or damaged materials.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Roof Hatches:

1. Babcock Davis.

2. Bilco Company.

3. Lane-aire Model CRH.

4. Dur-Red Products.

5. Equal.

B. Ventilators: Loren Cook Company, Greenheck, Grainger, or equal.

C. Smoke Hatches:

1. Babcock Davis.

2. Bilco Company.

3. Dur-Red Products.

4. Equal.

2.02 PRODUCTS

A. Roof Hatches: Provide roof hatches of indicated sizes. Hatches shall be fabricated of galvanized steel, 14 gage curb and cover, 22 gage cover liner, and 1 inch thick insulation in cover and curb. Cover shall operate by a compression spring enclosed in a telescopic case or enclosed torsion spring, with automatic hold-open arm. Provide padlock hasp on inside of unit. Include the following accessories:

1. Fixed hatch railing system, providing a permanent means of fall protection for roof hatch openings. Rail system shall meet OSHA Standard 29 CFR 1910.23(a)(3).

2. Ladder extensions. Bilco Model 1, "LadderUP Safety Post," Maxam Metal Products, "Spring Balance Safety Post", or equal, on fixed ladders below roof hatches. Device shall be manufactured of high strength steel with telescoping tubular section that locks automatically when fully extended. Upward and downward movement shall be controlled by a stainless steel spring balancing mechanism. Finish shall be hot dip galvanized. Unit shall be completely assembled with fasteners for securing to the ladder rungs in accordance with the manufacturer's instructions.

B. Gravity Ventilators: Provide ventilators at locations and of sizes and type indicated on plans. Ventilators shall be securely fastened to roof curbs as indicated in manufacturer's details. Ventilators shall have ½-inch mesh galvanized steel mesh bird screen.

C. Smoke Hatches: Manufacturer's standard, with [single] [double]-walled insulated curbs, welded or mechanically fastened and sealed corner joints, integral condensation gutter, and cap flashing. Fabricate with insulated double-walled lid and continuous weathertight perimeter lid gaskets, and equip with automatic self-lifting mechanisms and UL-listed [fusible links rated at 165 deg F] [fire-suppression system] [smoke-detection system].

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrate to receive roofing accessories and associated Work and conditions under which accessories will be installed. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install roof accessories in accordance with SMACNA and manufacturer's recommendations as required.

3.03 FIELD QUALITY CONTROL

A. Upon request of the Project Inspector, perform field water testing to demonstrate that 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 CLEANUP

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

END OF SECTION

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. Division 08 - Openings.

3. 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 MANUFACTURERS

A. Sealants must be approved by LAUSD's Office of Environmental Health and Safety (OEHS). Check OEHS website for approved products. Not all products by a manufacturer are approved by OEHS.

2.03 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	Sealant 6	To match adjacent

	horizontal surfaces of concrete; between metal and concrete masonry and mortar.		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 086223

TUBULAR DAYLIGHTING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Tubular daylighting devices and accessories.

1.2 RELATED SECTIONS

A. Section 075419 (07 54 19) - Adhered Thermoplastic (PVC) Feltback Membrane Roofing

B. Section 07600 (07 60 00) - Flashing and Sheet Metal. Metal curb flashings.

1.3 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
   1. AAMA/WDMA/CSA 101/I.S.2/A440 - Standard/Specification for Windows, Doors, and Unit Skylights; 2011.

B. American National Standards Institute (ANSI):
   1. ANSI C63.4-2014 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

C. ASTM International (ASTM):
   1. ASTM A463/A463M - Standard Specification for Steel Sheet, Aluminum Coated, by the Hot Dip Process.
   2. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc Coated (Galvanized), by the Hot Dip Process.
   3. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
   4. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   5. ASTM D635 - Test Method for Rate of Burning and/or Extent of Time of Burning of Self-Supporting Plastics in a Horizontal Position.
   6. ASTM D1929 - Test Method for Ignition Properties of Plastics.
   7. ASTM D2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.
   8. ASTM F1642 - Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loading.
   9. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   10. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.
   11. ASTM E283 - Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
   12. ASTM E308 - Standard Practice for Computing the Colors of Objects by

Using the CIE System.

13. ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors.
14. ASTM E547 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain walls by Cyclic Air Pressure Difference.
15. ASTM E1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missiles and Exposed to Cyclic Pressure Differentials.
16. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricane.
17. ASTM F2912 - Standard Specification for Glazing and Glazing Systems Subject to Airblast Loading.

D. California State OSHA Fall Protection Code of Regulations, Title 8, Section 3212 (e)(1).

E. Code of Federal Regulations (CFR):
1. CFR 47 - Code of Federal Regulations (CFR) Rules and Regulations for FCC, FCC Part 15 - Radio Frequency Devices, Subpart B - Unintentional Radiators, Section 15.107 - Conducted Limits, and 15.109 - Radiated Emission Limits

F. CSA Group (CSA):
1. CSA C22.2 No. 250.0 - Luminaires.

G. European Parliament Directive:
1. Restriction of Hazardous Substances (RoHS) - Directive 2011/65/EU Annex II including amendment (EU) 2015/863 (RoHS 3).

H. European Standards (EN):
1. EN 55015:2013+A1:2015 - Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment.
2. EN 60598-1:2015+A1:2018 - Luminaires. General requirements and tests.
3. EN 60598-2-2:2012 - Luminaires -- Part 2-2: Particular requirements - Recessed luminaires.
4. EN 61000-3-2:2014 - Electromagnetic compatibility (EMC). Limits. Limits for harmonic current emissions (equipment input current less than or equal to 16 A per phase).
5. EN 61000-3-3:2013 - Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤16 A per phase and not subject to conditional connection.
6. EN 61547:2009 - Equipment for general lighting purposes. EMC immunity requirements.

I. Factory Mutual (FM):
1. FM Standard 4431 - The Approval Standard for Skylights.

J. Federal Emergency Management Agency (FEMA):
1. FEMA P-361 - Safe Rooms for Tornadoes and Hurricanes.

K. General Services Administration (GSA):
1. GSA-TS01-2003: Standard Test Method for Glazing and Window Systems

Subject to Dynamic Overpressure Loadings.

L. International Building Code (IBC):
1. IBC Section 1710 - Load Test Procedure for Wind Load Testing on Rooftop Daylight Collecting System - Structural Performance Testing - Devised by ATI PE); 2012.
2. IBC Section 2606.7.2 - Installation - Diffuser Fall Out Test (Devised by PE); 2012.

M. International Code Council (ICC):
1. ICC 500 - Standard for the Design and Construction of Storm Shelters.

N. International Code Council Evaluation Service, Inc. (ICC-ES):
1. ICC-ES AC-16 - Acceptance Criteria for Plastic Skylights; 2008.

O. Florida Building Code (TAS):
1. TAS 201 - Impact Test Procedures.
2. TAS 202 - Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components Using Uniform Static Air Pressure Loading.
3. TAS 203 - Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.

P. OSHA 29 CFR - 1910.23 (e)(8) (Guarding Requirements for Skylights); 1926 Subpart M (Fall Protection); 1926.501(b)(4)(i); 1926.501(i)(2); 1926.501(b)(4)(ii).

Q. Unified Facilities Criteria (UFC):
1. UFC 4-010-01, Change October 2013, DoD Minimum Antiterrorism Standards for Buildings.

R. Underwriters' Laboratories (UL):
1. UL 2108 - Low Voltage Lighting Systems.
2. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products

1.4 PERFORMANCE REQUIREMENTS

A. Daylight Reflective Tubes: Spectralight Infinity with INFRAREDuction Technology combines ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance. Patented spectrally-selective optical surface yields an average total- and specular-reflectance for the Visible Light spectrum (400 nm to 700 nm) providing maximized visible light transmission and less than 25 percent reflectance for Infrared (IR) heat wavelengths (750 nm to 2500 nm) for minimized heat transmission, resulting in a spectrally-selective Total Solar Spectrum (250 nm to 2500 nm) reflectance less than 37 percent, as measured using a Perkin Elmer Lambda 1050 spectrophotometer with a Universal Reflectance Accessory. Color: a* and b* (defined by CIE L*a*b* color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance with ASTM E308.

B. SKYVAULT M74 DS / OPEN CEILING
1. AAMA/WDMA/CSA 101/IS2/A440, Class CW-PG80, size tested 36 inches by 36 inches (914 mm by 914 mm), Type TDD and Type TDDOC.
a. Air Infiltration Test: Single and Dual Glazed Dome (M74 DS Type DP and DPP):
1) Passes Air infiltration; maximum of 0.05 cfm/ft^2 (0.3 L/s/m^2) when

tested according to ICC-ES AC-16, and ASTM E283.
2) Meets or exceeds the air leakage performance levels with a maximum 0.4 cfm/ft^2 when tested in accordance with ASTM E283.
3) Air exfiltration will not exceed 0.4 cfm/sf aperture with a pressure delta of 1.57 psf across the tube when tested in accordance with ASTM E283.

b. Water Resistance Test
1) Single and Dual Glazed Dome (M74 DS Type DP and DPP): Passes water resistance; no uncontrolled water leakage with a pressure differential of 12.11 psf (580 Pa) or 15 percent of design pressure and a water spray rate of 5 gallons/hour/sf for 24 minutes when tested in accordance with ICC-ES AC-16, ASTM E547, ASTM E331, and TAS 202.

c. Uniform Load Test: All units tested with a safety factor of (3) for positive pressure and (2) for negative pressure, acting normal to plane of roof in accordance with ASTM E330.
1) Single and Dual Glazed Dome (Type DP and DPP): Design Pressure plus or minus 80.20 psf (plus or minus 3.84 kPa).
a) Passes uniform load test: No breakage, permanent damage to fasteners, hardware parts, or damage to make daylighting system inoperable or cause excessive permanent deflection of any section when tested at a Positive Load of 240.6 psf (11.52 kPa) or Negative Load of 160 psf (7.66 kPa) when tested according to ICC-ES AC-16, and ASTM E330

2. Hurricane Resistance:
a. Large Missile Impact test:
1) Single Glazed Dome (Type DP) Passes:
a) A minimum of missile level D for Wind Zone 4. No signs of penetration, rupture, or opening when tested in accordance with ASTM E1886 and ASTM E1996.
b) No signs of penetration, rupture, or opening when tested in accordance with TAS 201
2) Dual Glazed Dome (Type DPP) Passes:
a) No signs of penetration, rupture, or opening when tested in accordance with TAS 201

b. Uniform Static Air Pressure Test: Passes Design pressure rating a minimum of plus or minus 80.2 psf (3.84 kPa) when tested in accordance with ASTM E1886, ASTM E1996, and TAS 202

c. Air Infiltration Test:
1) Single Glazed Dome (Type DP) Passes:
a) Air Infiltration a maximum 0.05 cfm/ft^2 at 1.57 psf (25 mph) test pressure when tested in accordance with TAS 202
b) Air Infiltration a maximum 0.05 cfm/ft^2 at 6.24 psf (50 mph) test pressure when tested in accordance with TAS 202
2) Dual Glazed Dome (Type DPP) Passes:
a) Air Infiltration a maximum 0.04 cfm/ft^2 at 1.57 psf (25 mph) test pressure when tested in accordance with TAS 202
b) Air Infiltration, a maximum 0.05 cfm/ft^2 at 6.24 psf (50 mph) test pressure when tested in accordance with TAS 202.

d. Water Penetration Test:
   1) Single Glazed Dome (Type DP) Passes: No sign of water penetration at 12.11 psf (0.580 kPa) or 15 percent of Design Load when tested in accordance with TAS 202.
   2) Dual Glazed Dome (Type DPP) Passes: No sign of water penetration at 12.11 psf (0.580 kPa) or 15 percent of Design Load when tested in accordance with TAS 202.
e. Cyclic Wind Pressure Loading:
   1) Single Glazed Dome (Type DP): Passes. No signs of failure during the cyclic load test when tested in accordance with ASTM E1886, ASTM E1996, and TAS 203.
   2) Dual Glazed Dome (Type DPP): Passes. No signs of failure during the cyclic load test when tested in accordance with ASTM E1886, ASTM E1996, and TAS 203.

3. Wind Load Test:
   a. Daylight Collector System (Type C): Passes: No sign of failure or destruction when a maximum 2.5 times design load is applied laterally to the exposed cylindrical section when tested in accordance with IBC Section 1710 and Florida Building Code Section 1715.3 - Load Test Procedure for Wind Load Testing on Rooftop Daylight Collecting System - Structural Performance Testing - Devised by Architectural Testing Inc. PE.
   b. Design Load: 69.7 psf.
   c. Force Coefficients of Chimneys, Tanks, Rooftop Equipment, and Similar Structures according to ASCE/SEI 7-10 Figure 29.5-1
      1) Cross Section: Round
      2) Type of surface: Moderately smooth
      3) Ratio (h/D): 1.4
      4) Force coefficient: 0.6
4. Fire Testing:
   a. Fire Rated Roof Assemblies: When used with the Dome Edge Protection Band and mounted on curbs 4 inches high or greater, all domes shall meet the prescriptive fire rating requirements for Class A, B, and C roof assemblies as described in the International Building Code
   b. Self-Ignition Temperature Testing:
      1) Outer Dome Glazing (Type DP and DPP): Self-Ignition Temperature greater than 650 degrees F when tested in accordance with ASTM D1929.
      2) Inner Dome Glazing (Type DPP): Self-Ignition Temperature greater than 650 degrees F when tested in accordance with ASTM D1929.
      3) Cylinder Collector (Type C): Self-Ignition Temperature greater than 650 degrees F when tested in accordance with ASTM D1929.
      4) Diffuser (Type - All M74 DS): Self-Ignition Temperature greater than 650 degrees F when tested in accordance with ASTM D1929.
   c. Smoke Density Rating:
      1) Outer Dome Glazing (Type DP and DPP):
         a) Smoke Density Rating no greater than 450 per ASTM E84.

b) Smoke Density Rating no greater than 75 per ASTM D2843

2) Inner Dome Glazing (Type DPP): Smoke Density Rating no greater than 75 per ASTM D2843

3) Cylinder Collector (Type C):
   a) Smoke Density Rating no greater than 450 per ASTM E84
   b) Smoke Density Rating no greater than 75 per ASTM D2843

4) Light Transmitting Diffuser (Type - All M74 DS): Smoke Density Rating no greater than 75 per ASTM D2843

d. Rate of Burn and/or Extent of Burn:

1) Outer Dome Glazing (Type DP and DPP): Minimum CC-1 Classification less than 1 inch (25 mm) extent of burn per ASTM D635

2) Inner Dome Glazing (Type DPP): Minimum CC-2 Classification less than 2.5 inches/min (62 mm/min) rate of burn per ASTM D635.

3) Cylinder Collector (Type C): S Minimum CC-1 Classification less than 1 inch (25 mm) extent of burn per ASTM D635
   a) Raybender Daylight Lens (Type C): Minimum CC-2 Classification less than 2.5 inches/min (62 mm/min) rate of burn per ASTM D635.

4) Diffuser (Type - All M74 DS): Minimum CC-2 Classification less than 2.5 inches/min (62 mm/min) rate of burn per ASTM D635.

5. FM Certification:
   a. Spread of Flame: Passes: Class A at 5 in 12. No flame spread when tested in accordance with FM modified version of ASTM E108 Fire Test of Roof Coverings.
   b. Simulated Hail Resistance (Pre UV Exposure): Passes: No cracking or breaks when tested with nominal 2.0 in. (51 mm) diameter ice ball having a kinetic energy of 26.8 ft-lbs (36.4J)
   c. Simulated Hail Resistance (Post UV Exposure): Passes: No cracking or breaks when tested with nominal 2.0 in. (51 mm) diameter ice ball having a kinetic energy of 26.8 ft-lbs (36.4J) after no less than 1000 hours of ultraviolet (UV) light exposure.
   d. Simulated Impact: Passes: No breakage or through openings when a 100 lb (45.5 kg) weight dropped from 4 ft (1.2 m) above highest point of test sample.
   e. Simulated Wind Uplift: Passes: 195 psf Wind Rating. No separation, breaking or cracking occurred when tested in accordance with FM 4431.
6. Interior Finish Classification (IBC Section 803):
   a. Outer Dome Glazing (Type DP and DPP): Class B per ASTM E84
   b. Cylinder Collector (Type C): Class B per ASTM E84
   c. Diffuser (Type - All M74 DS): Comply with IBC Section 2606.7.2 (Diffuser Fall Out Test).
7. Fall Protection Performance
   a. Passes fall protection test: No penetration of dome or curb cap shall occur when subject to 700 lb (318.2 Kg)/60 second static load test and 700 lb (318.2 Kg)/2-foot (610 mm) impact drop test when tested in accordance with OSHA 29 CFR 1926 Subpart M (Fall Protection) 1926.501(b)(4)(i); 1926.501(i)(2); and 1926.501(b)(4)(ii).

b. Passes fall protection test: California State OSHA Fall Protection Code of Regulations, Title 8, Section 3212 (e)(1)

8. Blast Resistance: ASTM F1642, ASTM F2912, GSA-TS01-2003, and UFC 4-010-01:
   a. Airblast Loading ASTM Hazard Rating: Passes: No Break Rating
   b. Airblast Loading UFC Level of Protection: Passes High Level of Protection
   c. Dynamic Overpressure Loading ASTM Hazard Rating: Passes: No Break Rating
   d. Dynamic Overpressure Loading UFC Level of Protection: Passes High Level of Protection

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Data sheets showing roof dome assembly, flashing base, reflective tubes, diffuser assembly, and accessories.
   4. Installation requirements.

C. Shop Drawings. Submit shop drawings showing layout, profiles, and product components, including rough opening and framing dimensions, anchorage, roof flashings and accessories.

D. Electrical wiring diagrams and recommendations for power and control wiring.

E. Verification Samples: As requested by Architect.

F. Test Reports: Independent testing agency or evaluation service reports verifying compliance with specified performance requirements.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of twenty years experience in the top lighting industry. Secondary products shall be acceptable to the primary manufacturer.

B. Installer Qualifications: All products shall be installed by a single installer with a minimum of five years demonstrated experience, with adequate equipment, skilled workers, and practical experience to meet the project schedule.

C. Skylights shall conform with authorities having jurisdiction and be designed to meet design criteria of the project location and the following:
   1. Skylights must be certified by NFRC.
   2. Skylights must be Tested and labeled in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
   3. Skylights must have Factory Mutual (FM) Approval Class Number 4431.
   4. On projects which fall under the jurisdiction of the Florida Building Code, Skylights are required to have a current Florida Building Code (FBC) Number

to meet the High Velocity Hurricane Zone (HVHZ) requirements and are required for acceptance of Work specified in this section. Skylight must comply with the jurisdictional code body's submittal data and supporting drawings and documentation. Where the code body's acceptance criteria differs from these specifications regarding components and hardware, the code body's requirements shall govern.

5. Meet or exceed OSHA 200 pound (90 kg) Drop Tests expressed in 29 CFR 1910.23(e)(8)
6. Skylights shall provide minimum 69 psf (3.30 kPa) design load.

D. Pre-Installation Meeting: Contractor shall convene a pre-installation meeting on the project site minimum one week before beginning work of this Section. The meeting shall include the Architect or Owner’s Representative and representatives of all related trades to:

1. Coordinate between the at least the following trades.
   a. Roofing to install the flashing, skylight, and LED Light Kit (when specified)
   b. Electrical to wire components and program lighting controls.
2. Verify project requirements and site logistics.
3. Assess integrity of the roofing system and building structure.
4. Review manufacturer’s installation instructions and warranty requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in a cool dry location protected from the weather and in the manufacturer's original unopened containers until ready for installation.

B. Store products in manufacturer's unopened packaging until ready for installation.

1.8 PROJECT CONDITIONS

A. Coordinate delivery schedule with the Contractor and project schedule to minimize on site storage.

B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

C. Store materials in a dry area, protected from freezing, staining, contamination or damage.

1.9 WARRANTY

A. Daylighting Device: Manufacturer's standard warranty for 10 years.

B. Electrical Parts: Manufacturer's standard warranty for 5 years, unless otherwise indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Solatube International, Inc.; 2210 Oak Ridge Way, Vista, CA 92081. Tel. Toll Free: 888-765-2882. Tel: (760) 477-1120. Fax: (760) 597-

4488. Email: commsales@solatube.com. Web: www.solatube.com.

B. Substitutions: Or Equal

C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 TUBULAR DAYLIGHTING DEVICES

A. Tubular Daylighting Devices General: Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICC AC-16.

B. SkyVault Series: Solatube Model M74 DS.
1. Capture Zone:
a. Daylight Collector (Type C) with key components consisting of:
1) Collector Dome: Polycarbonate 0.125 inch (3.2 mm) minimum thickness classified as CC1 material; UV inhibiting; (100 percent UVC, 100 percent UVB and 98.8 percent of the range of UVA transmission). Dimensions: 31.5 inches (800 mm) diameter by 6 inches (152 mm) high.
2) Collector Cylinder: Polycarbonate 0.093 inch (2.4 mm) minimum thickness, classified as CC1 material; UV inhibiting, blocks all radiation <380nm: 100 percent UVC, 100 percent UVB and 76 percent of the range of UVA transmission). Dimensions: Dimensions 35.88 inches (911 mm) high by 51.5 inches (1308 mm) arc length.
3) Collector Cylinder Back Panel: Support for collector assembly. Fabricated of corrosion resistant zincalum steel sheet CS-B AZ50, conforming to ASTM A792/A792M, with a thickness of 0.0276 inch (0.7 mm). Dimensions: 36 inches (914 mm) high by 48 inches (1219 mm) arc length.
4) Collector Cylinder LightTracker Reflector: Daylight reflector. Aluminum sheet, thickness 0.018 inch (0.5 mm). Interior Finish: Spectralight Infinity with INFRAREDuction Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance. Dimensions: 36 inches (914 mm) high by 48 inches (1219 mm) arc length.
5) Micro-replicated Raybender HD Fresnel Lens: Daylight collecting lens. Impact resistant acrylic, 0.020 inch (0.51 mm) thick film with linear prism lens structure, classified as CC2 material. Dimension: 16 inch (406 mm) high by 51.75 inch (1314 mm) arc length.
6) Cylinder Collector Stanchion: “U” shaped support connecting the dome ring to the base cone assembly; (2) each. Fabricated of corrosion resistant galvanized steel sheet (G90), conforming to ASTM A653/A653M, with a thickness of 0.052 inch (1.3 mm). Dimensions: 36 inches (914 mm) high by 0.50 inches (12.7 mm) wide by 0.375 inches (9.5 mm) deep.
7) Base Cone Assembly: Conical shaped support connecting the daylight collection system to the curb-cap of associated TDD unit. Fabricated of corrosion resistant stainless steel (302/304), conforming to ASTM A463/A463M, with a thickness of 0.034 inch

(0.86 mm). Dimensions: 35.9 inches (912 mm) major diameter by 30.385 inches (772 mm) minor diameter by 2.28 inches (58 mm) high.

8) Upper seal (M74 DS Type C): Outer Dome, Cylinder Dome, and Back Panel interface. Adhesive backed PU foam ”D” profile with water resistant polymeric skin. Dimension: 0.375 inch (9.5 mm) wide by 0.25 inch (6.35 mm) high.

9) Lower seal (M74 DS Type C): Outer Dome and Support Cone interface. Adhesive backed 45 degree angle pile weather-strip. Dimension: 0.670 inch (17 mm) high by 0.27 inch (6.85mm) wide.

b. Domes:

1) Roof Dome Assembly: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.

a) Fasteners: Non-corrosive metal fasteners including non-magnetic stainless steel, zinc plated steel, aluminum, or injection molded nylon.

b) Dome Edge Protection Band: For Classified Roof Assemblies. For approved assemblies, curb height (by others or built on site) must be more than 8 inches (203 mm). Galvanized steel. Nominal thickness of 0.039 inch (1 mm).

2) Single Dome Glazing: Type DP.

a) Outer Dome Glazing: 0.125 inch (3.2 mm) minimum thickness, vacuum formed polycarbonate classified as CC1 material; UV inhibiting (100 percent UVC, 100 percent UVB and 98.8 percent of the range of UVA transmission).

b) Outer Dome Seals: Adhesive Back Closed Cell Foam Seal 0.25 inch (6.3 mm) tall by 0.75 inch (19 mm) wide.

3) Dual Dome Glazing: Type DPP.

a) Outer Dome Glazing: 0.125 inch (3.2 mm) minimum thickness, vacuum formed polycarbonate classified as CC1 material; UV inhibiting; (100 percent UVC, 100 percent UVB and 98.8 percent of the range of UVA transmission).

b) Inner Dome Glazing: 0.040 inch (1 mm) minimum thickness, copolyester (PETG) polyethylene terephthalate with glycol classified as CC2 material.

c) Seals:

1) Inner Dome Seal: Adhesive back closed cell foam seal 0.125 inch (3.2 mm) or 0.188 inch (4.8 mm) tall by 0.375 inch (9.5 mm) wide.

2) Dome Assembly Seal: Adhesive backed pile weather-strip, 0.350 inch (8.9 mm) tall by 0.187 inch (4.8 mm) wide.

c. Dome Options:

1) Security Guard: Type SG, welded powder coated steel or stainless steel rods 1/8 inch diameter mounted with an 8 inch maximum cross section. Assembly fastened with 1/8 inch diameter blind rivets in 6 locations to Curb-Cap assembly.

d. Flashings:

1) Curb Cap Flashing Base: Type FC one piece, seamless, leak-proof flashing, and base support for dome and top of tube and cap flashing. Fabricated of corrosion resistant sheet steel, conforming to ASTM A653/A653M or ASTM A463/A463M or ASTM A792/A792M, with a thickness of 0.0276 inch (0.7 mm) plus or minus .004 inch (.01 mm).
   a) Base Style: Curb-cap, with inside dimensions of 35.5 inches by 35.5 inches (905 mm by 905 mm) to cover curb specified in Section 07600.
   b) Insulation: Nominal 1 inch thick thermal isolation pad to reduce thermal conduction between curb-cap and tubing and thermal convection between room air and curb-cap. Rated R-6 ($^{O}Fxft^{2}xhr/Btu$) Insulation is Polyisocyanurate foam utilizing CFC, HCFC, and HFC free blowing agent. Type-1 Class-1 per ASTM C 1289; Passes UL 1715 (15-minute thermal barrier per IBC 2603.4); Attic ventilation may be required per IBC 1203.2.
   c) Curb Seal: Includes a double bead of adhesive backed closed cell foam seal 0.188 inch (4.8mm) tall by 0.375 inch (9.5mm) wide to reduce air infiltration.
   d) Tube Collar: Attached to top of curb-cap section; 0.018 inch (0.45 mm) nominal thickness aluminum conforming to ASTM B 209.
      1) Interior Finish: Spectralight Infinity with INFRAREDuction Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance.

e. Curbs: Metal Insulated Roof Curb: Corrosion resistant 18 Gauge hot-dipped galvanized steel conforming to ASTM A653 G90 with continuous welded seams, integrated base plate for water tightness and extra strength, lined with 1-1/2 inch fiberglass fireproof sound attenuating thermal insulation, factory installed 2 by 2 treated wood nailer secured to top ledge of curb. Curb designed for single-ply roofing, lightweight fill, or tapered insulation low slope roof types.
   1) C12 12 inch (305 mm) high Metal insulated curb.
   2) C14 14 inch (356 mm) high Metal insulated curb.
   3) C16 16 inch (406 mm) high Metal insulated curb.
   4) C20 20 inch (508 mm) high Metal insulated curb.
   5) CXX Metal insulated curb with a custom curb height as determined by the installer.

2. Transfer Zone:
   a. Extension Tubes: Aluminum sheet, thickness 0.018 inch (0.5 mm) conforming to ASTM B 209 with Tab-Lock tube joint structural connection system.
      1) Reflective Tubes:
         a) Reflective 24 inch (610 mm) extension tube, Type EXX or Type EL with total length of run as indicated on the Drawings.
         b) Belt Alignment Tab aligns Tube Belt on to tube in the correct location.
         c) Interior Finish: Spectralight Infinity with INFRAREDuction Technology combining ultra-high Visible Light reflectance

with Ultra-low Infrared (IR) reflectance.

2) Tab-Lock:
   a) Tab-Lock captures adjoining tube or tube connector using periodic opposing hooks integrated in the tube perimeter with mating retention detents.
   b) Hook system allows ease of tube engagement or disengagement for single operator from man-lift or rooftop.
   c) System intertwines the ends of the adjoining tubes and tube connectors between each Tab-Lock station.
   d) Intertwining function accepts tubes and connectors of common diameters that reduces light loss up to 2 percent per tube joint relative to tubes with 0.3 inch (7.6 mm) diameter difference.
3) Tube Belt:
   a) Sheet-metal belt 2 inch (50.8 mm) wide by 28.5 inch (724 mm) nominal diameter by 0.022 inch (0.5 mm) thick CS-B AZ-50 ASTM A792 with 0.10 inch (2.5mm) diameter stainless steel type 302 ASTM A313 torsion spring actuated toggle clamp.
   b) Retains Tab-Lock tube joint structural connection system; stiffens linear tube assembly; and prevents tube rotation or disengagement under normal use.
   c) Includes locking tab to prevent unintentional Tube Belt Latch opening due to handling, service, vibration, or normal operation or use.
4) Extension Tube Options:
   a) Reflective 48 inch extension tube, Type EL 48 inches (1220 mm) long. Use to replace two standard 24-inch (610 mm) extension tubes when long tube runs are required.
   b) Trim Ring: Type R. Provides a finished appearance to the installation, covering the cut edge of the roof deck penetration in an open ceiling application.
   c) Thermal Insulation Panel with Integral 24 inches (610 mm) Extension Tube: Type TIP, high-performance dual-glazed, thermally-broken tube insulation system consisting of two acrylic panels, spaced 1.0 inch (25.4 mm) apart, classified CC2 Class C material, 0.110 inch (2.8 mm) thick, housed in a polyethylene terephthalate glycol-modified (PETG) or acrylonitrile butadiene styrene (ABS) band classified as CC2 material 0.060 inch (1.5 mm) thick by 1.75 inch (44.5 mm) high with Spectralight Infinity high reflectance specular finish interior surface, and assembled with stainless steel disk spacers 0.0197 inch (0.5 mm) thick and aluminum rivets 0.13 inch (3.2 mm) fastened periodically around the perimeter. Dual-glazed Panel assembly integrated with a 12 inch (305 mm) Upper, and a 12 inch (305 mm) Lower Transition Tube made of Spectralight Infinity with INFRAREDuction Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance to form a nominal 24.9 inch (633 mm) tube assembly with integrated Tab-Lock connections.

3. Delivery Zone:
    a. Daylight Dimmer - 0 to 10 V Dimmer Control: Provide electrical actuator controller, auxiliary switches, and cable as specified in Section 25 50 00; Common Work Results Electrical Section 26 05 00; and Lighting Equipment and Controls Section 26 50 00.
        1) Low Voltage Daylight Dimmer, Type D1, is an Electro-mechanically actuated daylight valve; 0-10 V Control, Class-2, UL Listed. Low voltage Daylight Dimmer, an electrical actuator provides for programmable (0 to 10VDC) scene-based dimming control for daylight output between 0.5 and 100 percent, auxiliary 12VDC dimming control for daylight output between 2 and 100 percent, or auxiliary ON/OFF control. Input voltage: 24VAC at 50 or 60 Hz. Daylight Dimmer assembly integrated with a 12 inch (305 mm) Upper, and a 12 inch (305 mm) Lower Transition Tube made of Spectralight Infinity with INFRAREDuction Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance to form a nominal 24.9 inch (633 mm) tube assembly with integrated Tab-Lock connections.
            a) Programmable (0 to 10VDC) Control: requires an electrical actuator lighting controller or building automation controller capable of producing a signal between 0 and +10 VDC (Min 50mA) to incrementally modulate up to 50 daisy chained Daylight Dimmers (Current Sinking) between fully closed at 0 to 1 volts to fully open at 9 to 10 volts.
            b) Requires CL-2 (Min), 18 AWG, stranded copper, two conductor, twisted cable from lighting controller to first dimmer and interconnecting between subsequent dimmers.
            c) Auxiliary 12VDC Dimming Control: Requires 12VDC Dimming Switch (Current Sourcing; 12VDC power supply not required).
                1) Requires CL-2 (Min), 22 AWG, stranded, three conductor, twisted cable from switch to first dimmer and CL-2 (Min), 18 AWG, stranded copper, two conductor, twisted cable; interconnecting subsequent dimmers.
            d) Auxiliary ON/OFF Control: requires commercial or residential single pole electric light switch.
                1) Requires CL-2 (Min), 22 AWG, stranded, three conductor, twisted cable from switch to first dimmer and CL-2 (Min), 18 AWG, stranded copper, two conductor, twisted cable; interconnecting subsequent dimmers.
        2) Power can be transformed from line voltage through use of a UL Listed Class-2, 24VAC Transformer.
    b. Bottom Assembly:
        1) Base Diffuser Assemblies for Tubes Not Penetrating Ceilings (Open Ceiling): Type B, Solatube Model M74 DS-O. 28.5 inch (724 mm) diameter diffuser attached directly to bottom of tube.
            a) Diffuser Collar: Attached to diffuser lens; 0.018 inch (0.45 mm) nominal thickness aluminum.

1) Interior Finish: Spectralight Infinity with INFRAREDuction Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance.
2) Color: a* and b* (defined by CIE L*a*b* color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance with ASTM E308.

b) Diffuser Belt:
1) Sheet-metal belt 2 inch (50.8 mm) wide by 28.5 inch (724 mm) nominal diameter by 0.022 inch (0.5 mm) thick CS-B AZ-50 ASTM A792 with 0.10 inch (2.5 mm) diameter stainless steel Type 302 ASTM A313 torsion spring actuated toggle clamp.
2) Retains Tab-Lock tube joint structural connection system; stiffens linear tube assembly; and prevents tube rotation or disengagement under normal use.
3) Includes locking tab to prevent unintentional Latch opening due to handling, service, vibration, or normal operation or use.

2) Amplifier Assembly for Tubes Not Penetrating Ceilings (Open Ceiling): Type A, 36 inch (914 mm) diameter amplifier diffuser assembly attached directly to bottom of tube.
a) Amplifier: Conical shaped assembly 23.7 inches (602 mm) tall, 28.5 inches (724 mm) upper diameter, and 36 inches (914 mm) lower diameter.
1) Amplifier collimates incident light. Light reflects off 2 successively angled facets designed to mix the light to reduce glare and to correct the incident angle by 15 degrees and 25 degrees successively thereby improving the transmission efficiency through the diffuser lens by reducing retro-reflection due to first surface refraction and concentrating the distribution of light by reducing the cone of illumination relative to the incident angle correction.
2) Assembly comprised of 3 multifaceted segments to be joined together with 15 - 0.125 Inch (3 mm) rivets.
3) Tube Connect Slots at upper perimeter receive 6 Tab-Lock Hook features from adjoining tube for mechanical tube engagement.
4) Interior Finish: Spectralight Infinity with INFRAREDuction Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance.
5) Color: a* and b* (defined by CIE L*a*b* color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance with ASTM E308.

b) Amplifier Diffuser Belt:
1) Sheet-metal belt 2 inch (50.8 mm) wide by 36 inch (914mm) nominal diameter by 0.022 inch (0.5 mm)

thick CS-B AZ-50 ASTM A792 with 0.10 inch (2.5 mm) diameter stainless steel Type 302 ASTM A313 torsion spring actuated toggle clamp.

2) Retains Tab-Lock tube joint structural connection system; stiffens linear tube assembly; and prevents tube rotation or disengagement under normal use.

3) Includes locking tab to prevent unintentional Latch opening due to handling, service, vibration, or normal operation or use.

3) Diffuser Lens:

a) Lens: Type L2, Prismatic lens designed to maximize light output and diffusion. Visible Light Transmission shall be greater than 90 percent at 0.100 inch (2.5 mm) thick. Classified as CC2.

b) Diffuser Collar: Attached to diffuser lens; 0.018 inch (0.45 mm) nominal thickness aluminum.

1) Interior Finish: Spectralight Infinity with INFRAREDuction Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance.

c) Diffuser Seal: “L” shaped EPDM closed cell foam, , 0.86 inch (21.8 mm) wide by 1.37 inch (34.8mm) tall by 0.16 inch (4.1 mm) thick to minimize condensation and bug, dirt, and air infiltration per ASTM E283.

d) Diffuser Band: Stainless steel diffuser band, 0.25 inch (6.4 mm) wide by 0.020 inch (0.5 mm) thick stainless steel Type 201 ASTM A666, for enhanced seal performance and protection.

4) Options/Accessories

a) Optional Low-voltage Transformer: Solatube Remote Transformer, Type T20, is a 20VA, 24VAC, 50/60HZ, UL Listed, UL Category XOKV7, CE Marked, Class-2 Transformer with cover plate mounting system configured for easy field assembly onto standard 4.06 inch by 4.06 inch (103 mm by 103 mm) square junction box: Inherently Limited, Primary: 120VAC, 208VAC, 240VAC, and 277VAC.

b) Optional Low-voltage Transformer: Solatube Remote Transformer, Type TR96, is a 96VA, 24VAC, 50/60HZ, UL Listed, UL Category XOKV7, CE Marked, Class-2 Transformer with cover plate mounting system configured for easy field assembly onto standard 4.06 inch by 4.06 inch (103 mm by 103 mm) square junction box: Inherently Limited, Primary: 120VAC, 240VAC, 277VAC and 480VAC.

c) Switch: Type S1, is a Low-voltage 0-10V Class 2 control switch (white) required to operate 0-10V Daylight Dimmer. Note: only one switch is required per set of up to 50 synchronously controlled dimmers. For use with 0-10V Daylight Dimmer, Type D1, only.

2.3 ACCESSORIES

A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.

B. Suspension Wire: Steel, annealed, galvanized finish, size and type for application and ceiling system requirement.

C. Sealant: Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Examine openings, substrates, structural support, anchorage, and conditions for compliance with requirements for installation tolerances and other conditions.

C. If substrate and rough opening preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Coordinate requirements for power supply, conduit, and wiring.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's printed instructions.

B. Coordinate installation with substrates, air and vapor retarders, roof insulation, roofing membrane, and flashing to ensure that each element of the Work performs properly, and that finished installation is weather tight.
   1. Install flashing to produce weatherproof seal with curb and overlap with roofing system termination at top of curb.
   2. Provide thermal isolation when components penetrate or disrupt building insulation. Pack fibrous insulation in rough opening to maintain continuity of thermal barriers.
   3. Coordinate attachment and seal of perimeter air and vapor barrier material.

C. Where metal surfaces of tubular unit skylights will contact incompatible metal or corrosive substrates, including preservative-treated wood, provide permanent separation as recommended by manufacturer

D. Align device free of warp or twist, maintain dimensional tolerances.

E. Inspect installation to verify secure and proper mounting. Test each fixture to verify operation, control functions, and performance. Correct deficiencies.

3.4 FIELD QUALITY CONTROL

A. Provide independent testing and inspection as specified in Section 01 45 23. Inspect installation to verify secure and proper mounting.
   1. Test for water leaks in accordance with AAMA 502 after installation and curing of sealants but prior to installation if interior finishes.
   2. Perform test for total area of each unit skylight.
   3. Notify the Architect and the Contractor of any failed tests.

3.5 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before 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.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 06 1000 - Rough Carpentry.

3. Section 07 9200 - Joint Sealants.

4. 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. Gypsum Board Type X (fire-resistant) or Type C or Type ULIX as required by fire rated design and acoustic requirements: 5/8 inch thick, 4-foot wide and up to 16-foot long conforming to ASTM C1396 with long edges tapered.

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. Joint mortar and Tape for Cement board.

a. Use type as recommended by cement board manufacturer

b. Fiberglass tape: Durock brand tile backer tape

c. Joint Mortar: Meet ANSI 118.4

E. Finishing Materials: Texture coat finish material shall be manufactured by U.S. Gypsum, Hamilton, or Highland Stucco and Lime Products, Inc., or equal.

F. 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.

G. 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.

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.

3.05 TEXTURE COAT

A. Spray install texture coat to interior gypsum board surfaces where indicated on Drawings.

B. Texture coat shall provide a uniform splatter pattern finish with an 80 percent minimum coverage of the entire surface area.

C. Provide protection from spray for interior surfaces of electrical boxes and wiring.

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 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. 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.

2. 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.

3. Concrete: 3 coats.

a. First: Concrete sealer.

b. Second and Third: Interior enamel, semi-gloss or gloss as indicated.

4. 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 09 9013

PAINTING OF EXISTING FACILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior and exterior painting.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 02 8333 – Lead Abatement and Lead-Related Construction Work.

3. Section 02 8213 – Asbestos Abatement and Asbestos Related Disturbance.

4. Section 07 9200 - Joint Sealants.

5. Section 09 2900 - Gypsum Board.

1.02 REGULATORY REQUIREMENTS

A. Workers shall be trained in EPA's (Environmental Protection Agency); Renovation, Repair and Painting (RRP), the lead-related construction course that satisfies the requirements specified in 40 CFR, Part 745, Section 745.90.

B. The Lead Related Construction Work, specified herein, shall be performed by a company, partnership, corporation, sole proprietorship or individual doing business, association, or other business entity; a Federal, State, Tribal, or local government agency; or a nonprofit organization, shall satisfy the requirements specified in 40 CFR, Part 745, Section 745.89, as a Lead-Safe Certified Firm.

C. Prior to commencement of Asbestos Related Construction Work, personnel required to construct and enter the Work Area or handle Asbestos Containing Materials shall have received adequate training, minimum of 16 hours of O&M training comprised of 2 hours of Awareness Training and 14 hours of Special O&M Training, in accordance with the requirements by 40 CFR, Part 763, Subpart E (AHERA) and Title 8, Section 1529, of the California Code of Regulations.

D. Paint materials shall comply with Food and Drug Administration's (FDA) Lead Law and current rules and regulations of local, state and federal agencies governing use of paint materials.

E. Paint color requirements for CALOSHA: CALOSHA requires the following items be painted as prescribed:

1. Gas Mains and Valves shall be painted “gun metal gray” (medium gray).

2. Fire Valves and Raisers shall be painted OSHA’s “safety red”.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 3300: Submittal Procedures.

1. Submit a complete list of materials to be furnished stating supplier and distributor's names with product recommendations.

2. Submit manufacturer's standard color samples for each type of paint specified. Once colors have been selected, submit six samples of each color selected for each type of paint, on standard 8 ½ by 11 spray-out panel.

3. Before any coating is applied, submit to Project Inspector samples of each color to be used on contract. If more than one batch of material and color is to be used, samples from each batch shall be submitted.

B. Paint and Enamel Spray-Outs:

1. Samples of Paint and Enamel shall be submitted on standard 8 ½ by 11 Leneta Opacity-Display Charts. Each display chart shall have color in full coverage. Sample shall be prepared using material from batch to be used on actual job. Identify school on which paint is to be used, batch number, color number, type of material, name of manufacturer and name of CONTRACTOR.

2. Furnish samples of colors to Project Inspector. Samples shall be kept on the job until painting is completed.

3. CONTRACTOR shall be responsible for finish color on surface to be painted; where different materials of same color are specified to be applied on same, or adjoining surfaces, final color match shall match color sample on those surfaces.

C. Elastomeric coating shall be submitted in duplicate samples of texture coating. Samples shall be not less than 2 ½-inch by 3 ½-inch in size and on adequate backing.

D. Provide the current SCAQMD permit for each HEPA Vacuum and Portable Mechanical Ventilation System before they are brought onto the Project site.

E. Materials and color samples shall be approved before a job start meeting will be scheduled.

1.04 QUALITY ASSURANCE

A. Certification of Materials: With every delivery of paint materials manufacturer shall certify, on form supplied by OWNER that materials comply with requirements of this Section.

B. Paint materials shall be approved by OWNER'S Office of Environmental Health and Safety (OEHS) Chemical Evaluation Program and comply with applicable requirements of Food and Drug Administration's (FDA) Lead Law and South Coast Air Quality Management District (SCAQMD).

C. Painters working on Lead related work shall be trained at a minimum, in EPA's Renovation, Repair and Painting (RRP) Rule.

1.05 DELIVERY, STORAGE AND HANDLING

A. Materials shall be delivered to project site in original unbroken containers bearing manufacturer's name, brand number, batch number, and Safety Data Sheets.

B. Open and mix ingredients on premises in presence of Project Inspector. Immediately remove rejected materials from premises.

1.06 METAL STORAGE CONTAINER

A. Storage and Mixing of Materials: Store materials and mix only in spaces designated for purpose by Project Inspector. Keep such spaces clean and take necessary precautions to prevent fire. Hang out oily rags singly in open air. Stack paint containers so that manufacturer's labels are clearly displayed.

B. Paint, combustible materials, gasoline driven equipment, etcetera shall not be stored or left in any school building overnight.

C. In event that equipment and material storage sheds must be placed on asphalt pavement less than six months old, each wheel, leg or other supporting member shall be centered on a 4-foot by 8-foot by ¾ inch thick sheet of plywood. Shed shall be set down in such a manner as to prevent damage to pavement. CONTRACTOR shall be responsible for any damage to pavement caused by improper placement of shed.

1.07 ENVIRONMENTAL CONDITIONS

A. Temperature: Do not apply exterior paint in damp, rainy weather or until surface has dried from effects of such weather. Do not apply paint, interior or exterior, when temperature is below 55 degrees F., humidity is above 80%, or above manufacturer's stated recommended temperature, or when dust conditions are unfavorable to proper workmanship.

1.08 WARRANTY

A. Manufacturer shall provide a three year material warranty from date of Substantial Completion.

B. CONTRACTOR warrants work executed and materials furnished under Contract shall be free from defects of materials and application for a period of three years from date of Substantial Completion.

C. Elastomeric coating shall be warranted for a period of five years from date of Substantial Completion.

1.09 PROTECTION

A. Fire alarm boxes, fire sprinkler heads, smoke detectors and intrusion alarm systems shall be uncovered and available to perform function that it was designed for each and every night.

B. Pressure relief grilles with barometric damper leading to a corridor or an exterior shall be masked off before spraying and then uncovered immediately after spraying.

C. Conspicuously post sufficient “Wet Paint” signs continuously to alert public and school personnel to existing conditions until paint is completely dried.

D. Provide and maintain barriers, guards, lights, warning signs, etcetera for complete protection and as directed by the Project Inspector.

E. Do not impede emergency egress.

1.10 REMOVAL AND REINSTALLATION OF SECURITY GRILLES

A. Replace and secure at end of each working day protective security grilles. Every bolt shall be replaced properly using a washer, cut smooth and filed down.

B. Remove window grilles and anchoring devices prior to painting area behind grille.

C. Repair or replace grills, anchoring devices, and hardware damaged during removal and replacement process with material of same composition.

D. Reinstall grilles; anchoring devices and hardware shall be replaced with new hardware of same material. Installation of previously used or damaged hardware and anchoring devices shall not be permitted.

E. Provide hardware, specialty tools, and labor needed to remove and reinstall window grilles.

F. Paint security grilles that have graffiti or have been vandalized.

G. Do not leave any building or classroom unsecured. Grilles shall be reinstalled and rooms properly secured at end of each day.

H. Patch holes that exist prior to removal of grilles or that are exposed or created during removal.

I. Removal and Replacement

1. Grille and window sill shall be numbered prior to removal. Grille must be reinstalled to original location. Remove numbers upon reinstallation.

2. Window grilles may have been anchored in different ways according to building composition and grille type. Following is a list of different types of anchors and methods of removal and installation. (Processes listed are not applicable to every situation. Use appropriate methods as needed, with prior consent of Project Inspector).

a. Nail in Anchor:

1) Removal: Use cold chisel to split aluminum head, pull out steel nail in center, and then pull out aluminum sleeve or grind off aluminum head to reveal nail, then remove nail. Touch up grille with approved spray cold galvanize where galvanize has been damaged from grinding.

2) Reinstallation: With grille flush to wall, insert anchor flush with mounting tab, and drive nail with hammer until secure. Bent nails will not be accepted.

b. Threaded Anchors:

1) Removal: Grind off tack weld only, threaded stud shall remain in wall. Remove nut, washer, and grille. Touch up galvanizing damaged during grinding.

2) Reinstallation: Install grille without damaging anchor threads. Install new washer and nut, tack weld nut to tab, clean weld, and paint. Do not weld threads.

c. Carriage Bolts: Note: Extra-long carriage bolts are a specialty item. Allow sufficient time to order.

1) Removal: Remove nut and washer and pull out bolt (do not reuse).

2) Reinstallation: Replace with new bolt of same size and minimum of 1 inch longer than bold removed. Install a new fender washer and nut. Tighten until grill is firmly against wall. Check to make sure window operates correctly. Cut off bolts flush with nut and de-burr bolt.

d. Lag Type Screws

1) Removal: Remove nut and washer and pull out bolt (do not reuse).

2) Reinstallation:

a) If existing hole is capable of receiving new screw: Replace with new lag, of same diameter, using 1 inch longer than those removed. Tack weld screws to grille.

b) If existing hole is damaged or otherwise compromised, a new placement of tab and screw is necessary. Remove existing tab, offset location of tab 2 inches, and drill correct size pilot hole into wood frame to avoid splitting wood. Replace with a new lag, of same length and diameter as removed. Tack weld screws to grill. Welds shall be cleaned and painted with cold galvanized paint.

e. Tamper Proof Screws

1) Removal: Remove nut and washer and pull out bolt (do not reuse).

2) Reinstallation:

a) If existing hole is capable of receiving new screw: Replace with new screw, of same diameter, using 1 inch longer than those removed.

b) If existing hole is damaged or otherwise compromised, a new placement of tab and screw is necessary. Remove existing tab, offset location of tab 2 inches, and drill correct size pilot hole into wood frame to avoid splitting wood. Replace with a new screw, of same length and diameter as removed. Welds shall be cleaned and painted with cold galvanized paint.

f. Pop Rivet-Steel, Aluminum, or Stainless Steel. Note: Extra-long pop rivets are a specialty item. Allow sufficient time to order.

1) Removal: Drill out with proper size drill bit, do not increase hole size.

2) Reinstallation: Replace with new pop rivet, of same diameter and composition as rivet removed.

3. Grilles reinstalled in exact prior position. Do not use plastic anchors or toggle bolts. Grilles have been installed with expanded metal situated in a consistent directional manner and shall be reinstalled in same manner. Extra or oversized

holes shall be repaired. If for any reason anchor will not securely hold, use next bigger size anchor and offset tab 2 inches and re-anchor as per OAR direction.

4. Repair damage that previously exists prior to removal or is done to existing concrete, brick, wood, or any other surface during removal. If welding is necessary, welder shall protect surfaces from damage and maintain a fire watch during welding and at least ½ hour after completion.

5. Do not change original type of anchor without prior approval from OAR and Project Inspector.

6. Comply with applicable lead and asbestos abatement requirements prior to removal of grilles. Only employees properly trained and certified shall be permitted to disturb building materials containing lead or asbestos.

1.11 MOVING EQUIPMENT

A. Perform handling and moving of furniture, equipment, casework, books, and supplies, or items impeding project and re-installing in their original location, except as otherwise directed by OAR. Library books shall be moved and re-shelved in same sequence and in same location from which they were removed, unless otherwise directed by OAR.

1.12 MISCELLANEOUS

A. Provide and maintain barriers, guards, lights, warning signs, etcetera for complete protection and as directed by the OAR. Provide access to doors and openings. Do not store equipment or material near openings or traffic lanes that could be hazardous during an emergency.

1.13 DEFINITION OF TERMS

A. Work shall include labor, material, equipment and scaffolding required for cleaning and preparation of surfaces to receive painters finish and for painting and varnishing, as herein specified. Perform work unless specifically noted otherwise.

B. Painting shall include complete preparation and finish or refinishing in accordance with requirements specified herein. Drywall shall be treated same as specified for plaster.

C. Wherever woodwork is specified to be refinished, it will include wood finish member (trim), movable cabinets with doors and center cut doors, windows and sash, screen doors, screens, sash poles, movable and fixed bulletin boards and chalkboards, etcetera.

D. Plastic, impregnated plywood, hardwood, metal, asbestos board (if painted), and mastic coated wood surfaces shall be treated in same manner as specified for “woodwork”.

E. Whenever “Paint or Enamel” is referred to in these specifications, it shall be taken to mean types of waterborne materials and water reducible materials.

F. Whenever “edges” are referred to in these specifications, it shall be taken to mean every edge (which include tops and bottoms).

G. Work shall be done by skilled and experienced painters in a professional manner. Painters must wear presentable white uniforms consistent with industry standard and personal ID Badges.

1. Provide ID badges identifying the following:

a. Employee’s name.

b. Employee’s photo.

c. Company Position (i.e. apprentice, journeyman, foreman).

d. Company name and logo.

e. Company phone number.

1.14 SCAFFOLDING

A. Scaffolding and aerial lifts shall be made available to OWNER, without cost, to make repairs. OWNER will coordinate its work with that of CONTRACTOR’s to avoid delays to the work.

1.15 SCHEDULING OF WORK

A. Schedule work through the OAR.

PART 2 - PRODUCTS

2.01 PAINT MATERIALS

A. Factory mix paint materials to correct color, gloss, and consistency for installation to maximum extent feasible.

B. Paint materials shall be by one manufacturer.

C. Paint materials shall be “Premium Plus or Ultra Premium Grade”.

D. Acceptable manufacturers, unless otherwise noted:

1. Dunn-Edwards Corporation Paints.

2. Vista Paints.

3. Frazee Paints and Wall coverings.

4. Sherwin Williams.

5. PPG Paints.

6. Equal.

E. 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

PART 3 – EXECUTION

3.01 REMOVE AND REINSTALL

A. Remove coat hooks, name plates, label frames, sash lifts, sash locks, pencil sharpeners, flag brackets, drawer handles and locks, window coverings, switch and receptacle plates, removable bulletin boards, mirrors, maps and thermometer. Reinstall all of the above after painting is completed.

B. Remove exposed nails, hooks, tacks, screws, staples and pins in surface to be painted and patch holes with a matching material. Remove interior and exterior obsolete screens, grille hangers, fasteners and patch holes.

C. Remove and reinstall Venetian blinds and channels ensuring security latches are secure. When removed, blinds and channels shall be marked with its location and reinstalled in the same location.

D. CONTRACTOR shall replace map and picture hooks as directed by the Project Inspector.

E. Paper labels shall be soaked off and glue residue from tape removed.

F. Remove metal or plastic room numbers, letters, signs, and, after painting is complete, clean and reinstall them neatly.

G. Sash locks shall be reset in accordance with instructions for locking doors and windows each night.

3.02 REPLACEMENT SCREWS AND HARDWARE

A. Hardware shall be replaced using new screws, of same diameter, but one size longer than those removed. Screws used must be of finish design and material to match hardware.

B. Remove paint from hardware, including paint from previous painting.

3.03 GENERAL PREPARATION OF EXISTING PAINTED SURFACES

A. Previously painted surfaces will be assumed to contain lead.

B. Trenching: Before any cleaning or sandblasting operation is started, soil at base of building shall be trenched to a depth of six inches and eight inches wide. After completing painting application and allowing sufficient drying time, trench shall be refilled.

C. Insure a consistently uniform horizontal, vertical and curved surface, with a maximum deformation of 1/8 inch in a five foot span on an exterior stucco/masonry finish. For stucco/masonry repair, apply an exterior patching material, bringing the surface flush with the existing finish while matching the existing building textured finish.

D. Glass, fiberglass and polycarbonate on exterior shall be traced neat and clean with approximately, but no more than 1/16 inch overlay. Paint specks, smears or splatters shall be immediately removed and surface cleaned.

E. Miscellaneous Exterior Surfaces; Freestanding exterior school signs, windbreaks, baffles, benches, scoreboards, fences and gates (excluding chain link), decorative panels, interior and exterior surfaces of display cases, storage and supply cabinets, including both sides and edges shall be prepared and primed as specified under “Doors.” They shall receive number of coats of paint as detailed under “Colors and Number of Paint Coats.”

F. Examine surfaces to receive paint finish. Surfaces which are not properly prepared, and cleaned or which are not in condition to receive finish specified, shall be corrected before paint is applied. Painting shall not be done on existing painted surfaces until surfaces are approved by the Project Inspector.

G. Remove items fastened to existing painted surfaces and patch holes with a material and re-fasten in original location upon completion of painting work.

H. Existing painted surfaces indicated to be painted, shall be prepared as follows:

1. Wood, plaster and metal surfaces shall be washed with TSP (tri-sodium phosphate) substitute to remove dirt, grease and other foreign materials and rinsed with clean water and then sand papered and dusted off. Surfaces shall have wax completely removed before washing, which includes base, shoe base, and concrete base.

2. Checked, cracked, blistered, scaled, peeling, and alligatored paint on wood and metal surfaces shall have paint removed down to original finished surface, then hand-sanded and dusted clean.

    a. Surfaces shall then be considered as new work.

    b. Woodwork shall be hand sanded smooth after each and every coat, except last coat. Coats shall be free from dust, dirt or other imperfections.

c. Steel sash and aluminum sash to be painted must be steel-wooled and dusted off. Sash putty shall be hand sanded smooth and dusted off.

d. Remove lint and grease from screens, vents, hoods, et cetera that are to be painted.

3.04 OTHER SURFACE PREPARATION REQUIREMENTS

A. Existing painted surfaces shall be prepared and made ready to receive new coat of paint or other finish coating materials by any of following methods:

1. Checked, cracked, blistered, scaled loose, and alligator paint on wood and metal surfaces on exterior or interior of facilities shall be wet scraped and wet sanded to a smooth solid surface, H.E.P.A. vacuumed, wet wiped as specified per EPA RRP and then painted as specified. Wet scraping and or wet sanding shall be performed only when school is not in session, and students and staff are not on site.

2. Trenching: Before any cleaning or sandblasting operation is started, soil at base of building shall be trenched to a depth of six inches and eight inches wide. After completing painting application and allowing sufficient drying time, trench shall be refilled.

3. Sandblasting and/or pressure washing shall not be allowed without prior approval from the OWNER's Facilities Environmental Technical Unit. Only low pressure hydro-washing, below 750 psi, shall be allowed on all exterior surfaces.

4. Hydro-washing: Exterior masonry and plaster on buildings, bungalows, pavilions, and appurtenances must be washed with a cleaner using hydro-washing equipment, or as directed by Project Inspector, to remove grease, dirt and foreign materials and then rinsed with clean water to remove residue. Surfaces must be allowed to dry for at least five days or as determined by Project Inspector. Care shall be taken to prevent water from entering buildings through vents, et cetera. Immediately following hydro-washing, areas surrounding buildings must be rinsed down. Ensure no rinse water enters storm drains.

a. Exposed mastic, concrete, and/or plaster surfaces shall be cleaned with a cleaner, using hydro-cleaning equipment. This process is to remove dirt, foreign materials, grease, and oil and rinsed with clean water to remove residues.

b. Before hydro-washing efflorescence must be brushed off and surface treated with a 10 percent solution of Muriatic Acid, neutralized with a 10 percent solution of ammonia water and then rinsed with clean water.

c. Painted surfaces that will be directly or indirectly impacted by hydro-washing shall have paint stabilized to remove loose, flaky or peeling paint using the wet method. Wood, metal, and other exterior non-

masonry/stucco surfaces shall be primed where stabilization has occurred prior to application of cleaner and hydro-washing.

d. Hydro-washing is not intended to remove loose, flaky or peeling paint or paint chips. Water generated from cleaning and hydro-washing process shall be collected and stored in DOT approved container and examined for the presence of paint chips. The visible paint chips shall be separated from the waste water and be disposed of as assumed RCRA hazardous waste or be characterized to determine disposal requirements. The remaining wastewater must be characterized for proper disposal in accordance with Specification 02-8333, Lead Abatement and Lead Related Construction Work.

e. At no time shall water from hydro-washing process be directed to soil, such as planted area, sewer system, storm drain, be allowed to flow off OWNER property to adjoining public or private property, or to flow across asphalt or cement concrete and allowed to dry.

f. Hazardous waste generated by this process requires that the Office of Environmental Health and Safety (OEHS) be notified. Hazardous waste shall be being transported under a Uniform Hazardous Waste Manifest approved by OEHS prior to disposal. CONTRACTOR shall ensure the manifest is completed as required by code and then submit it to OEHS for approval. The OAR will sign the manifest once it is accurately completed and approved by OEHS prior to transport.

5. Sandblasting: Shall be performed when school is not in session and when students are not present. Premises shall be left in a clean condition and ready for use by occupants by end of any day prior to beginning of school session. Work shall be coordinated with Project Inspector and the OAR. Only wet blasting shall be allowed. Masonry or stucco surfaces shall be sandblasted to remove mastic, paint and other materials to original plaster brown coat or formed concrete surface. Rinse with clean water to remove residue. Adjacent surface, plants and shrubs shall be protected from damage due to sandblasting operations.

   a. Immediately upon completion of sandblasting operation, roof, gutters and areas around buildings, etcetera shall be cleaned of sand and debris resulting from sandblasting operation. No sand or debris shall be hosed or swept into drains.

   b. Metal surfaces including decorative metal and fencing requiring sandblasting shall be sandblasted to white metal and primed same day with a metal primer per manufacturer’s recommendation.

6. Sandblasting and Pressure Washing of materials containing asbestos or lead are abatement activities and will only be performed by companies and individuals with prior Facilities Environmental Technical Unit (FETU) approval.

3.05 CRACKS AND VOIDS

A. Voids between wall and ceiling surfaces and wood or metal trim or scribed edges where finish exists or is specified to be applied and including picture molding, must be filled with putty, filler or latex sealing compound.

B. Areas where finish plaster coat is loose must have that portion removed to a solid surface. Surfaces that are broken, cracked, or damaged and areas where finish plaster coat has been removed must be coated with compatible bonding agent. Surface will then be given a cement plaster finish coat consisting of one-part Plastic Portland Cement to three parts sand to match existing finish. Cracks shall be “V-eed” out, filled, finished flush with and textured to match adjoining surfaces, per OWNER Representative’s approval.

C. Neutralize walls showing effects of alkali.

3.06 FILLER ON SIDING AND WOODWORK

A. Checked and cracked portions of siding and woodwork (after surrounding areas have been prepared as specified above) shall be primed, smoothed with an exterior filling compound and then sanded smooth when dry. Filled areas must be spot primed. Filler shall not be used on handball walls or basketball backstops.

3.07 SEALING SASH, DOOR FRAMES

A. Sealant that will interfere with proper application of coatings shall be removed. Seal around door and window frames, flashing, vents, separations between masonry or plaster and adjoining surfaces, etcetera, with a sealant compound recommended by manufacturer of coating to be used. Sealing and filling shall be done with sufficient pressure to force material to base of opening.

3.08 MASTIC REPAIR AND ELASTOMERIC REPAIR

A. Surface must be clean, firm and free of oil, wax and chalk. Mildew must be killed. Surface must be rinsed and allowed to dry.

B. Use primers as recommended by manufacturer for each substrate.

C. May be applied with airless spray equipment, using a 22 to 34 orifice tip and do not apply when surface or air temperature is below 50 degrees F.

D. Apply elastomeric with a ½ inch to 1 ½-inch roller cover or an air-atomized spray texture pump system. Do not over-roll.

E. Spreading rate:

Fine texture:	Approx. Mil thickness	Wet	18 Mils
	at 80 square feet per gallon	Dry	9 Mils

Medium texture:	Approx. Mil thickness	Wet	18 Mils
	at 60 square feet per gallon	Dry	9 Mils
Heavy texture:	Approx. Mil thickness	Wet	39 Mils
	At 40 square feet per gallon	Dry	26 Mils

NOTE: Coverage will vary depending upon texture desired and surface. Direction will be given by an OWNER representative.

F. Dry time: To touch: 1 to 1 ½ hours

To re-coat: 24 hours

G. Finish will be uniform in texture and free of imperfections.

H. Elastomeric coatings will receive at least two coats of paint.

I. Hairline cracks: Two coats of elastomeric coating to bridge hairline cracks.

J. Small to medium cracks and imperfections: elastomeric coating to fill and span cracks up to 1/32 inch. Cracks 1/32 inch width or greater shall be treated with an elastomeric sealant (recommended by paint manufacturer) prior to applying elastomeric coating.

K. Medium to large cracks and imperfections: Cracks from 1/32 inch to 1/8 inch shall be treated with a brush-grade elastomeric sealant applied in a 2-inch wide band; crowned at center and feathered at edges to conceal repair.

L. Large cracks: Cracks 1/8 inch to ½ inch shall receive a urethane sealant (recommended by paint manufacturer), “rake out” crack to conform to manufacturer’s specifications and applied as directed for medium to large cracks.

M. Cracks, holes and damaged spots larger than ½ inches: Damaged areas shall be given a cement plaster finish coat consisting of one-part plastic Portland cement to three-parts plaster sand to match existing finish. When finished, it shall be flush with and match existing texture of adjoining surface.

N. Texture match: Crack repairs shall be finished to match texture of adjoining surfaces, per Project Inspector’s approval. Hand held plaster hopper guns may be used. Exercise care to ensure that areas finished by hand held plaster machines match in color, texture and thickness to adjoining surfaces. A compatible bonding agent shall be used.

3.09 REPAIR OF PLASTER

A. Exterior areas, where finish plaster coat is loose, shall have that portion removed to a solid surface. Surfaces that are broken, cracked, or damaged and areas where finish plaster coat has been removed shall be coated with compatible bonding agent. Surface will then be given a cement plaster finish coat consisting of one-part Plastic Portland

Cement to three parts plaster sand to match existing finish. Cracks shall be “veed-out”, filled, finished flush with and textured to match adjoining surfaces, per Project Inspector’s approval.

1. If existing plaster was a machine applied, dash coat, apply final application of finish coat over patched areas by machine to match existing adjacent machine texture. Use a finish plaster material with a bonding admixture mixed according to manufacturer's recommendation.

2. Cracks, holes, and damaged spots larger than ½ inch, see Article Mastic Repair and Elastomeric Repair.

B. Exterior plaster designated to be painted shall receive three coats. First coat shall be sealer. Second and third coats shall 100 percent acrylic gloss enamel unless otherwise indicated.

C. Interior plaster patching shall receive four coats. First coat shall be pigmented sealer. Second coat shall be enamel undercoat. Third and fourth coats shall gloss or semi-gloss enamel as indicated.

3.10 REPAIR OF SPALLING CONCRETE

A. Remove surface contamination, broken and spalled concrete to a sound concrete base. Concrete shall be removed to a depth of one-half inch minimum around rebar. Sides of areas to be repaired shall be straight, not tapered or sloped.

B. Spalled or loose concrete shall be removed using an electric or compressed air chipping hammer.

C. Clean exposed rebar by sand/media blasting, remove debris and dust and treat steel with a sealant compatible to patching materials same day. Project Inspector shall approve sealant application prior to any patching materials being applied.

D. Repair concrete to match existing concrete surfaces using Sika Top 123 Gel Mortar, DAP Concrete Patch, Quikrete Fast-Setting Concrete, or equal.

E. Sealant and patching materials shall be applied by qualified applicator.

3.11 SPRAYING MASONRY/CEMENT PLASTER

A. Masonry/plaster material must be a 100 percent acrylic flat paint, color as directed. Material must be applied in strict conformity to manufacturer’s directions. There must be at least 24 hours drying time between first coat which shall be factory tinted 10 percent to 15 percent lighter (or darker) in color than finish coat. Manufacturer shall be acquainted with conditions of surfaces to be refinished and provide written specifications for the job including special primers or additives needed for adhesion sealing of first coat of paint and general performance of materials. Finished surface must be uniform and free of imperfections. Each coat applied to surface must be sprayed using “Cross-Off” method

of application by spraying horizontally with a 50 percent overlap on returns and doubling back with a vertical stroke with a 50 percent overlap on returns.

3.12 CAFM BUILDINIG NUMBERS

A. After painting of masonry/plaster, paint and repaint (stencil) CAFM numbers with 100 percent acrylic gloss in one location on each building. Numbers shall be 6 inches in height using Gothic Bold Army font. Color is to be Black on light color surfaces and White on dark color surfaces. Coordinate with OAR color selection for surfaces and locations.

3.13 STAINED AND VARNISHED SURFACES

A. Where existing varnish has been removed and woodwork is to be enameled, woodwork shall be primed as specified under “Priming” and then given three coats. First coat of enamel undercoat, second and third coats of gloss or semi-gloss enamel.

B. Interior woodwork having a stain and varnish finish shall have areas where painter’s finish has been removed, build-up to match adjoining finish with stain, filler for open wood grained wood and varnish. Exposed surfaces of woodwork shall be given two coats of interior gloss varnish, and one coat of interior varnish, semi-gloss finish or as specified herein. Between coats of varnish, surfaces shall be sanded with #220 sandpaper or steel-wool and dusted clean.

C. Where exterior gloss varnish for finish coat is specified, method of build-up shall be as specified above, however exterior gloss varnish shall be used in lieu of interior varnish. When following items are to receive varnish, three coats of exterior gloss varnish shall be used on: window stools, sash, screens, exterior doors/frames, wood handrails, balustrade caps, chalk rails, toilet stall doors, fixed benches, sash poles, stair treads, risers, bleachers, base and base shoe.

D. Remove stains from varnished surfaces before refinishing.

E. Colored varnish is prohibited.

3.14 SASH PUTTY

A. Loose sash putty must be removed and replaced. Rough, uneven or otherwise deteriorated sash putty shall be sanded smooth or re-puttied.

B. Sash putty and sealing compound shall be painted with same number of coats as specified for woodwork.

3.15 PUTTY

A. Holes, open joints of siding, woodwork and sash glazing shall, after surrounding areas have been prepared as specified above, be knife puttied. On stained woodwork, putty must be colored to match stain. Puttying shall be done after first coat of paint or varnish

has been applied. Latex sealant may be used on open joints and woodwork. Putty and/or sealant shall be spot primed before finish coat is applied. Putty or latex sealant shall not be used on handball walls or basketball backstops.

3.16 FILLER ON SIDING AND WOODWORK

A. Checked and cracked portions of siding and woodwork (after surrounding areas have been prepared as specified above) shall be primed, smoothed with an exterior filling compound and then sanded smooth when dry. Filled areas must be spot primed. Filler shall not be used on handball walls or basketball backstops.

3.17 MIXING AND APPLICATION

A. Colors of coatings shall be as directed by Project Inspector.

B. Three coats of paint shall be applied as follows:

1. First coat: primer or undercoat, shall be white or may be tinted up to 50% lighter or darker than the finish coat at the discretion of the installer.

2. Second coat shall be factory tinted in range of 10 percent to 15 percent lighter or darker than finish coat.

3. Third coat shall be factory tinted to color selected but allowing for tint variations in more than one color for application to different surfaces. Color combinations in rooms and for surfaces shall be varied in accordance with color letter.

C. Any number of colors may be used on any portion of work. OWNER reserves right to change colors before work is started in an area or on a particular surface.

D. Various colors may require additional coats of paint complete coverage. No additional allowances will be made. CONTRACTOR is responsible for consulting color letter and knowing color and coverage.

E. Surfaces to be finished and each coating shall be separately inspected by Project Inspector and checked for mill thickness. The requirements are two mils each coat wet and three mils dry after three coats. Notice that such work is ready for inspection shall be given to Project Inspector. Should such notice not be given before succeeding coat is put on, finish applied shall be removed or an additional coat shall be applied, as directed by Project Inspector. Allow at least one day drying time between coats for exterior work or as directed by Project Inspector for proper drying.

F. Roof work to be painted Q8-38T Birch Gray.

3.18 PAINT ROLLERS, BRUSH AND SPRAY

A. Paint rollers may be used on interior plaster, drywall, masonry, stucco and plywood surfaces, nap not to exceed 1/2 inch in length.

B. First coat on wood overhang and ceilings must have material applied by roller and then must be brushed out in a professional manner to leave surface free of imperfections. Finish coat may be sprayed.

C. Other surfaces shall have coatings applied with brushes of proper size.

D. Spray work shall be permitted only on radiators, acoustic plaster, acoustic tile, fiberboard, wood fiber acoustical units, masonry and plaster or as directed by Project Inspector.

3.19 PRIMING

A. Surfaces from which paint finish have been removed down to original wood or metal surfaces shall be primed as follows:

1. Wood shall be sealed or primed with a non-water borne material on both sides and edges. Wood completely sealed with a non-water borne material shall be top coated with a water borne material as specified herein. Finish material (water borne) shall be compatible with non-water borne primer per manufacturer's recommendations. Hardwood shall be filled and stained to an even color.

2. Galvanized Metal: Clean oil and foreign material from surfaces. Apply a metal clean and etch pretreatment coating. Follow manufacturer's instructions for drying time, and then prime with one coat of metal primer.

3. Ferrous and non-ferrous metal: Use a primer for ferrous and non-ferrous metal.

3.20 FIRE AND LIFE SAFETY EQUIPMENT

A. Cal-OSHA requires the following equipment be painted as follows:

1. Gas Mains and Valves shall be painted "gun metal gray" (medium gray).

2. Fire Valves and Raisers shall be painted OSHA's "safety red".

3.21 DOORS

A. Painted or refinished interior and exterior wood or metal doors must be finished on both sides and edges with three coats of paint consisting of first coat of primer, second coat and third coat of exterior high gloss enamel.

B. Where doors open into rooms or spaces having different finishes, communicating doors must have edges finished according to industry standard or as directed by Project Inspector.

1. Strike edge of door shall be same color as inside face of door.

2. Hinged edge of door shall be same finish as outside face of door.

C. Exterior hardwood doors and frames where varnish finish has been removed shall be built-up to match adjoining finish with stain, filler and one coat of exterior varnish. Then surfaces, including edges must be given specified number of coats of exterior varnish as detailed under “Stain and Varnish Finish.”

3.22 RAMPS, STAIRS AND HANDRAILS

A. Unpainted, painted and mastic coated classroom ramps, treads, risers and thresholds of building shall be prepared as specified herein and painted with two coats of Monochem DEX-COAT textured paint or equal.

B. Handrails shall be finished same as specified for exterior wood doors using exterior gloss enamel.

3.23 THRESHOLDS

A. Painted thresholds to be prepared, primed, and receive two coats of a non-skid porch and deck paint.

B. Natural finished wood thresholds to be prepared and receive three coats of a high gloss varnish.

3.24 INTERIOR AND EXTERIOR WOODWORK

A. Wood surfaces shall be prepared to receive new finish as specified under Articles Preparation of Surfaces and Priming. Wood surfaces (with the exception of wood classrooms and offices walls which shall be painted in a semi-gloss finish) shall be painted with three coats of paint consisting of first coat of primer, second coat and third coat of exterior high gloss enamel.

3.25 ENAMEL FINISH

A. Interior woodwork having an existing enameled finish must have areas where painter’s finish has been removed and where spackling has been done in repairing defects in surface, built-up with undercoat. Wood surfaces shall then be given one coat of undercoat, a second coat and third coat of finish paint to match room finish. Paint shall be applied as specified under “Colors and Number of Coats.”

B. Unpainted plaster surfaces to receive an enamel finish, must receive four coats of paint. First coat of pigmented sealer, second coat of enamel undercoat, third and fourth coats of gloss or semi-gloss enamel as specified herein.

C. Previously painted interior surfaces must have patching and places where painted finish has been removed, built up with one coat of a pigmented sealer. Then entire surface including patching shall be given one coat of an enamel undercoat, a second and third coat of gloss or semi-gloss enamel as specified herein.

3.26 CABINETS

A. Cabinets without doors, cabinets with glass doors and pegboard doors shall have interiors finished to match surrounding or adjacent work, unless interior has a stained finish.

B. Cabinets having solid panel doors must have exposed parts of cabinet and surfaces of doors finished to match room finish. Shelf edges shall be finished same as room finish.

3.27 PLYWOOD WALLS

A. Interior plywood walls having an existing stain finish must have exposed plywood joints machine sanded to remove projecting edges and prepared as follows:

1. Voids between wall surfaces and wood or metal trim or battens, and nail holes must be filled with putty, sealant, or an exterior filler, sanded smooth when dry and dusted clean.

2. Interior walls must be sanded smooth, brushed off and finished with three coats of paint. First coat of enamel undercoat, second and third coats of semi-gloss enamel.

3. Exterior plywood shall be cleaned and finished with three coats. First coat shall be undercoat. Second and third coats shall be gloss enamel. Exterior plywood may be sprayed if it is then back-rolled.

3.28 INTERIOR PLASTER AND DRYWALL WORK – WALLS AND CEILINGS

A. Where ceilings are specified to be painted, beams, cornices, coves, ornamental features, staff work, plaster grilles, etcetera shall be included.

B. Ceilings shall be white, unless otherwise noted. Includes classrooms, storage rooms, offices, arcades, etcetera. Boiler room and fan room ceiling color shall match adjacent walls.

C. Where walls are specified to be painted, columns, staff work, piers, returns, reveals, soffits of stairs, both sides of stair railings, soffits and reveals of windows and other openings shall be included.

D. Grease, ink spots and marks of indelible pencils shall be completely removed by use of water and abrasive soap powder without injury to finished surface.

E. First coat may be thinned per paint manufacturer’s recommendation with a thinner prepared specifically for material used. Coats shall be flowed on freely. First coat must be prepared so as to stop suction, and should any dead spots appear, they shall be touched up before next coat is applied. The last coat shall be a uniform surface, free of defects.

3.29 AREAS REQUIRING ENAMEL

A. Interior and Exterior Enamel – Gloss: Woodwork, walls and ceilings (except acoustic tile or acoustic plaster or as otherwise specified herein) in following areas:

1. Physical Education and Gym Buildings.

2. Cafeteria: Except student and teachers' dining rooms.

3. Shops.

4. Miscellaneous Rooms: Toilet rooms, custodian closets, storerooms, boiler and mechanical rooms.

5. Kitchen Complex: Color; Eastwind – Q7-16P.

B. Interior and Exterior Enamel – Semi-Gloss: Woodwork, walls and ceilings (except acoustic tile or acoustic plaster or as otherwise specified herein) in following areas:

1. Administrative offices.

2. Faculty lounges and auditoriums.

3. Walls and surfaces in rooms or areas specified to receive an enamel finish and not herein specified to receive a Gloss Enamel finish, shall have a finish coat of Semi-Gloss Enamel.

C. Interior masonry, brick and concrete surfaces having an existing painter's finish shall be finished same as specified for interior plaster and drywall. Concrete pan ceilings may be sprayed as directed by Project Inspector.

3.30 UNPAINTED METAL

A. Unpainted bronze, brass, copper work, window grilles, stairways, handrails, chain-link fences, stainless steel, open metal shelving, porcelain metal faced cabinets and aluminum will not be painted, unless otherwise specified.

3.31 PAINTED METAL

A. Exposed structural steel, miscellaneous/ornamental iron, sheet metal work, guards, steel sash, gates, painted aluminum, basketball rims, etcetera shall have surfaces cleaned and prepared as specified. The areas from which original painter's finish has been removed shall be spot primed with metal primer to match adjoining surfaces and then surfaces shall be given a prime coat of metal primer, second and third coats as specified. Copper pipe shall be painted with one coat of enamel undercoat per manufacturer's recommendation, a second and third coat of enamel as specified.

B. Painted ornamental iron rails and gates, metal ceilings (metal decking, etcetera) stairs, pipe columns, and pipe rails shall be prepared and finished as specified herein. Metal decking and metal roll-up doors may be sprayed.

C. Exterior surfaces (except bottom) of exterior metal storage containers, including both sides of door(s) and edges shall be prepared and painted with three coats of paint consisting of first coat of primer, second coat and third coat of exterior high gloss enamel. Exterior metal storage container(s) must be sprayed.

3.32 METAL COVERED DOORS, RADIATORS

A. Metal Covered Doors: Bare metal must be primed with a metal primer. Doors and edges shall then be painted with one coat of enamel undercoat, a second coat and third coat of exterior gloss enamel as specified.

B. Fly screens and hardware cloth of copper, bronze or galvanized wire must be painted with one coat of exterior enamel.

C. Radiator guards must be removed, painted with three coats of enamel to match adjoining surface and replaced after radiators have been painted.

3.33 LIGHT FIXTURES

A. Exterior/interior light fixtures (other than plated or bronzed) and bells to be primed and then painted with two coats of an enamel to match adjoining surface. Bell identification plates must have paint removed and be kept clean.

B. Metal stacks and kilns must, after preparation, receive two coats of aluminum paint or a heat resistant material. Minimum required heat resistant coating shall be rated to not less than 700 degrees F.

C. Cafeteria equipment: Metal work in cafeteria, kitchen and serving counters in student and faculty dining rooms having an existing aluminum paint finish must be cleaned as specified and given two coats of an aluminum paint.

3.34 FLAG AND LIGHT POLES

A. Clean by wire-brushing and sanding to remove foreign debris, loose paint, rust, etcetera from pole, platform, steps, cage area and mechanical fixtures related to those areas. After removing loose paint, feather-edge sand surrounding areas of existing finish. Remove dust. Exclude electrical fixtures.

B. Spot-prime with a quick-dry metal primer.

C. Apply by brushing first and second coat of aluminum paint per manufacturer’s time recommendation for re-coating.

D. Rolling or airless spraying is not permitted on flag and light poles.

3.35 METAL SHOWERS AND DRESSING ROOMS

A. The exterior and interior surfaces of metal shower stalls and dressing rooms in locker and shower rooms to be cleaned of rust, dirt, grease and loose materials. Where painters finish has been removed, area to be built-up with a coat of rust preventive primer and then surfaces shall be given first, second and third coats as specified under “Areas requiring enamel.”

3.36 PAPER TOWEL BOXES

A. Metal boxes for paper towels, toilet paper and metal sanitary boxes, must be enameled with two coats of gloss white enamel.

3.37 METAL SURFACES

A. Clean by wire-brushing and sanding to remove foreign debris, loose paint, rust, etcetera. After removing loose paint, feather-edge sand surrounding areas of existing finish. Remove dust.

B. Exterior bare metal surfaces shall be primed with a metal primer then painted with a first coat of enamel undercoat, then a second coat and third coat of exterior gloss enamel.

C. Hardware having a painted finish shall have paint removed. Doors closers shall be finished with a leather brown or aluminum paint. Aluminum paint shall be applied in sanitary areas such as cafeterias, dining rooms and toilet rooms. Leather brown (N-2501) paint shall be used in other areas.

3.38 METAL LOCKER FINISH

A. Following items in physical education and gymnasium buildings, (including related physical education buildings, such as locker rooms, field houses, etcetera and buildings having lockers or like equipment) must be washed with a silicone wax and grease remover, rinsed and have scratches, marks and defacements “feathered out.” Then surfaces must be given one coat of a primer and two finish coats of a gloss metal enamel finish. Surfaces must be free from sags, runs, over-spray, etcetera.

1. Interior and exterior surfaces of faculty and students’ metal lockers, metal shelving for drawers of wire baskets and drawer type lockers or as specified.

2. Plated hardware, locks, name plates and number tags shall be masked off and adjoining surfaces shall be protected while spraying. If locks are to be removed, they shall be removed and reinstalled by OWNER.

3.39 PAINTING OF MECHANICAL WORK

A. Exposed heating, ventilating, air conditioning, plumbing, electrical equipment, apparatus, piping, ducts, coverings, etcetera shall be cleaned, prepared and painted as specified herein for that item.

1. In finished areas, these items must be finished with one coat of primer and two coats of enamel to match adjoining wall or ceiling finish as specified herein.

B. Radiator branches, risers, returns, radiators, supports and other types of heating equipment in finished spaces shall be finished with three coats of paint to match adjoining finish as specified herein. Gas steam radiators shall be disconnected and reconnected by OWNER.

C. Register faces and grilles, unless plated, must be given three coats of paint to match adjoining finish as specified.

D. Ventilators and interior sheet metal ducts must be treated and finished as specified for interior metal work.

E. Coverings on pipes in finished rooms must be finished same as adjoining wall or ceiling surfaces. Do not break surface of any wrapped pipes.

F. Labels on fire alarm systems, bells, pulls must be covered and kept intact. Fire alarm bells and pulls to be painted red gloss paint.

G. Covering on boilers, tanks, pipes, etcetera in boiler room and heater room must be primed and then finished with gloss enamel.

H. Valves, pipe hangers, flanges, unions, drain pipes, soil lines, exposed blow-off pipes, boiler fronts, smoke boxes, breeching, iron boiler bases, metal stacks, water column/pipe connections, damper regulators, manholes, safety valve connections, boiler appurtenances, etcetera, located in boiler room must be painted with two coats of a boiler paint as recommended by paint manufacturer.

I. Pumps, fans, fan housing, belt guards, including supports, motors, or other equipment, cover plated to sump pump, tank, manhole covers/rings mounted in floors including conduits and piping in boiler or fan rooms must be primed and then finished with two coats of gloss enamel as specified herein.

J. Mechanical work not specifically mentioned must be painted as specified for other work of same character.

K. Finished bronze, brass fittings, plated work, name plate and fusible links and chains must be cleaned of paint.

L. Pressure relief grilles with barometric dampers leading to a corridor or to exterior must be masked off before spraying any material.

M. Automatic sprinkler valves, gas meters and water meters must be painted as specified herein.

3.40 ELECTRICAL CABINETS

A. Front side of doors and exposed lip around doors to electrical cabinets in finished areas must be finished same as walls.

3.41 ACOUSTICAL PLASTER, TILE, FIBERBOARD

A. Acoustical plaster shall be cleaned to remove dust before painting.

B. Acoustical plaster shall be sprayed with One full Coat of Pigmented Sealer and then with two coats of Vinyl Wall paint, using “cross-off” method of spraying horizontally with a 50 percent overlap on each stroke and then doubling back with a vertical application with a 50 percent overlap on each stroke.

C. Acoustic tile, wood fiber units, and fiberboard shall receive not less than two coats of a fire retardant paint with a flame spread rating of not more than seventy-five feet on acoustical tile as evaluated by a tunnel test and shall be currently recognized by State Fire Marshal’s Office. Fire retardant shall be applied in strict conformity to manufacturer’s directions. The above surfaces shall be sprayed using “cross-off” method. Before fire retardant coating is applied, ceiling shall receive one full coat of pigmented sealer. Kitchens shall receive two coats of gloss finish after receiving one full coat of a pigmented sealer.

3.42 CORK AND FIBERBOARD TACK BOARDS

A. Unpainted cork board panels used in connection with chalkboards or bulletin boards shall be finished with two coats of vinyl wall paint, factory tinted to match wall color and brushed on. Where cork strips are inset in head trim on chalkboards, cork shall be either varnished or enameled to match wood trim.

B. Painted cork board and unpainted or painted fiberboard panels shall be finished with two coats of vinyl wall paint.

C. Where cork or fiberboard has been painted with water-soluble paint, this water-soluble paint shall be washed off and allowed to dry. Surface shall then be painted as described above.

3.43 CHALKBOARDS

A. Chalkboards (including portable chalkboards) shall be washed with a strong solution of a cleaner as per manufacturer’s recommendation, rinsed with clear clean water to remove chalk dust and allowed to dry. Fill joints and repair defects such as cracks and holes with paste wood filler colored with paint to match chalkboard. After filler has hardened sufficiently, repaired spots shall be sanded smooth to level of adjacent surfaces.

B. Apply two coats of chalkboard paint. Paint shall be liquid slate green as manufactured by Cal-Western, Rust-Oleum, Valspar, or equal. Sand between coats with #180 wet-or-dry sandpaper. Paint shall be rolled with a ¼ inch nap and brushed out.

C. After final coat, entire surface must be finished smooth with #400 wet or dry sandpaper.

D. Finished board must present a surface free of defects and brush marks and shall meet approval of Project Inspector.

E. Do not paint natural slate chalkboards.

3.44 LETTERING

A. Lettering and numerals on glass, fiberglass, plaster, and surfaces to be refinished shall be reproduced in original locations and will be of size, color and design as directed by Project Inspector and OAR. An experienced sign painter shall do lettering.

3.45 HARDWARE AND AUTOMATIC DOOR CLOSERS

A. Hardware having a painted finish must have paint removed. Doors closers must be finished with a leather brown or aluminum paint. Aluminum paint shall be applied in sanitary areas such as cafeterias, dining rooms, toilet rooms. Leather brown (N-2501) paint shall be used in other areas. Where both sides of doors are specified to be painted, door closers shall be included.

3.46 GAS FIRED UNITS

A. Gas fired units, which need to be disconnected and reconnected, and/or any unit that must be shut down, re-ignited and tested will be done by OWNER personnel.

3.47 CLEANING

A. Glass, polycarbonate and fiberglass on interior and exterior where painting has been done shall be cleaned of paint and varnish. Glass, fiberglass and polycarbonate that are scratched or damaged by painting work, shall be replaced with material to match original.

B. Finished bronze, copper, brass fittings, plated work, name plate and fusible links and chains shall be cleaned of paint.

C. Before applying finish coat of material to exterior sash with security grilles, CONTRACTOR shall clean window panes with a cleaner.

D. Dispose of debris, waste or unused materials, off site. Use of school dumpsters is strictly prohibited.

E. Remove paint from hardware, including paint from previous painting.

F. CONTRACTOR shall free sash and leave it in an easy operating condition.

G. Glass, fiberglass and polycarbonate on exterior shall be traced neat and clean with no more than 1/16 inch overlay. Paint specks, smears or splatters shall be immediately removed and surface cleaned.

H. Rooms, Buildings, and Campuses must be cleaned of paint debris, including dust caused by painting project to approval of Project Inspector and OAR.

3.48 POST OCCUPANCY WORK

A. Two months after substantial completion, OAR will arrange a date and time when the CONTRACTOR must return to the site to check and free sashes that were painted so they are in proper operating condition.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.

2. Trapeze pipe hangers.

3. Thermal-hanger shield inserts.

4. Fastener systems.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.03 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.05 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.06 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2019 CPC).

2. 2019 California Plumbing Code.

3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.

4. National Fire Protection Association.

5. California Division of the State Architect.

6. California State Division of Industrial Safety.

7. County Health Department.

8. Any other legally constituted body-having jurisdiction thereof.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.07 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.08 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.09 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.10 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.11 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.12 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.

2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.

3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.

4. To be valid, all submittals must:

   a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.

   b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.

   c. Include all pertinent construction, installation, performance and technical data.

   d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

      1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.

      2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

   e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

   a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

      1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding

proposed substitution item shall be clearly labeled “PROPOSED SUBSTITUTION”.

b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor’s responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.

3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.

4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.

5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.13 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.14 UNINSPECTED WORK

A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.

B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.15 RECORD DRAWINGS

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.16 GUARANTEES

A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.01 Pipe Supports: Unless otherwise indicated on the drawings, shall be as follows:

A. The Contractor shall furnish and install all miscellaneous iron work including angles, channels, etc., required to appropriately support the various piping systems. Hanger spacing and location shall conform to 2019 California Plumbing Code Table 313.1.

B. All horizontal runs of piping within the building to be supported from the structural framing with steel rods and split ring hangers, B-Line, Grinnell Company, Tolco, or approved equal. Steel rods shall be secured to overhead framing with side beam connectors. Where necessary, install angle iron between framing to accommodate hanger rods. Where several pipes are running together, Unistrut, B-Line or Powerstrut channels with clamps may be used in lieu of

individual pipe hangers, and supported from structure as herein specified. Submit test data for type of hanger supports to be provided. For support conditions other than specified herein, the Contractor shall submit method of support for approval prior to any installation.

C. Horizontal Piping Hangers and Supports:

1. General: Provide factory fabricated horizontal hangers and supports complying with one of the following MSS types listed to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.

   a. Adjustable Steel Clevis Hangers: (MSS Type 1.) B-Line B 3100

   b. Adjustable Swivel Pipe Rings: (MSS Type 5) B-Line B3690

D. Vertical-Piping Clamps:

1. General: Provide factory fabricated vertical-piping clamps complying with the following types listed, to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.

2. Two-Bolt Riser Clamps: (MSS Type 8) B-Line B3373

E. Hanger-Rod Attachments:

1. General: Provide factory fabricated hanger-rod attachments B-Line, Tolco or approved equal, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-58 and manufacturer's published product information. Select size of hanger-rod attachment to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.

2. Side beam eye socket, Tolco Fig. #57 for rod sizes 3/8" dia. and Tolco Fig. #25-30-251 for rod sizes 1/2" dia.

F. Building Attachments:

1. General: Provide factory fabricated building attachments, selected by Installer to suit building structural framing conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.

G. Hanger Rods and Spacing shall conform to the following table:

Pipe Sizes	Spacing	Rods

2 Inch and Smaller	6 Feet	3/8 Inch
2-1/2 Inch to 3 Inch	8 Feet	1/2 Inch
4 Inch and larger	8 Feet	5/8 Inch

H. Hangers and Supports shall be adequate to maintain alignment and prevent sagging and shall be placed within 18 inches of joint. Support shall be provided at each horizontal branch connection.

I. Provide lateral bracing as manufactured by B-Line or approved equal for all piping to prevent swaying or movement in accordance with SMACNA "Guidelines for Seismic Restraints of Piping Systems". Piping smaller than indicated in the guidelines shall be provided with bracing as specified for the smallest size indicated. The entire water distribution system shall be properly braced and will not move due to the action of quick closing of valves.

J. Miscellaneous Supports, Wall Brackets, Etc.: Provide where required in accordance with the best standard practices of the trade. Submit shop drawings for all fabricated supports.

2.02 Isolators. All piping which is not isolated from contact with the building by its insulation shall be installed with a manufactured type isolator. Isolators shall be B-Line vibra clamp and cushion, Super Strut, Stoneman "Trisolator", or approved equal. Piping shall be installed and supported in a manner to provide for expansion without strains. Guides shall be properly installed to ensure this requirement.

2.03 Shields:

A. General: Provide shields at piping hangers and supports, factory-fabricated, for all insulated piping as manufactured by Pipeshields Incorporated or approved equal. Size shields for exact fit to mate with pipe insulation.

1. Protection Shields: MSS Type 40; provide high density insert of same thickness of insulation or equal 100-psi average compressive strength, waterproofed calcium silicate, encased with a sheet metal shield. Insert and shield shall cover entire circumference of the pipe and shall be of length indicated by manufacturer for pipe size and thickness of insulation.

2.04 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.

3. Nonmetallic Coatings: Plastic coating, jacket, or liner.

4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.

2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.05 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.06 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ERICO International Corporation.

2. PHS Industries, Inc.

3. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.

4. Piping Technology & Products, Inc.

B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig ASTM C 552 or Type II cellular glass with 100-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.07 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.08 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

    b. NPS 4: 12 inches long and 0.06 inch thick.

4. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099123 "Interior Painting."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.

2. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. C-Clamps (MSS Type 23): For structural shapes.

6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.

7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

9. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

2. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 22 05 29

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.

2. Domestic hot-water piping.

3. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:

1. Section 220716 "Plumbing Equipment Insulation."

1.03 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.04 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2019 CPC).

2. 2019 California Plumbing Code.

3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.

4. National Fire Protection Association.

5. California Division of the State Architect.

6. California State Division of Industrial Safety.

7. County Health Department.

8. Any other legally constituted body-having jurisdiction thereof.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.05 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.06 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.07 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.08 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.09 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation.

The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.10 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.

2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.

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1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.

2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

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b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor’s responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.

3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.

4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed

alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.

5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.11 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.12 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.13 UNINSPECTED WORK

A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.

B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.14 RECORD DRAWINGS (Also see General Conditions)

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.15 GUARANTEES

A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

1.16 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.17 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.18 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. Hot Water Pipe Insulation: All hot water supply and return piping, except exposed connections to plumbing fixtures, flanges and unions shall be insulated with ASTM C547, Class I, "Johns-Manville" "Micro-Lock" 850-APT, Owens-Corning Fiberglass Corp., ASJ/SL-11 or approved equal, 1" thick for sizes up to 2" and 1-1/2" thick for sizes 2" and larger with “Johns-Manville” “Zeston” pre-formed insulation inserts for all fittings. Insulation at all fittings shall be equal in thickness to insulation for piping. Insulation shall have a flame spread of not more than 25 and a smoke density not exceeding 50 per 2019 CMC

1. Exposed insulated piping in occupied areas and exposed outside the building shall be covered with Johns-Manville” “Zeston” 30-mil thick white PVC jacketing material per ASTM D1784 with “Johns-Manville” “Zeston” pre-formed insulation inserts for all fittings. Insulation at all fittings shall be equal in thickness to insulation for piping. Jacketing shall comply with ASTM E84, and shall have a flame spread of not more than 25 and a smoke density not exceeding 50 per 2019 CMC.

2. Hot water piping below slab shall have insulation protected by a 10-mil thick polyethylene plastic sleeve sealed watertight with poly vinyl chloride tape.

B. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

C. Products shall not contain asbestos, lead, mercury, or mercury compounds.

D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

E. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

F. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Johns Manville; Micro-Lok.

b. Knauf Insulation; 1000-Degree Pipe Insulation.

c. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

H. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Armacell LLC; Tubolit.

b. Nomaco Insulation; IMCOLOCK and NOMALOCK.

I. Condensate Pipe Insulation: All condensate piping within the building shall be insulated with "Imcoa" "Imcolock" ¾" nominal wall thickness closed-cell insulation. Insulation shall have a flame spread of not more than 25 and a smoke density not exceeding 50 per 2019 CMC. All joints shall be mitered and secured with black duct tape.

J. All insulation shall be continuous through supports and hangers.

K. All fixtures complying with the provisions of the Americans with Disabilities Act shall be provided with Prowrap insulation for exposed hot water pipe, tailpiece, and trap as manufactured by McGuire, and secured per manufacturers recommendations. No tape wrapping shall be permitted.

2.02 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.

b. Eagle Bridges - Marathon Industries; 225.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Phenolic Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-96.

b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-33.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.

b. Eagle Bridges - Marathon Industries; 225.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide the following:

a. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.03 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 428 AWF ASJ.

b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.

c. Compac Corporation; 104 and 105.

d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.

3. Thickness: 11.5 mils.

4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch in width.

7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 370 White PVC tape.

b. Compac Corporation; 130.

c. Venture Tape; 1506 CW NS.

2. Width: 2 inches.

3. Thickness: 6 mils.

4. Adhesion: 64 ounces force/inch in width.

5. Elongation: 500 percent.

6. Tensile Strength: 18 lbf/inch in width.

2.04 SECUREMENTS

A. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

2.05 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers,:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. McGuire Manufacturing.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.

2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.

2. Testing agency labels and stamps.

3. Nameplates and data plates.

4. Cleanouts.

3.04 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.05 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe

insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe

insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.06 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.

4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

4. Install insulation to flanges as specified for flange insulation application.

3.07 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.

2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.08 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.09 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.

2. Underground piping.

3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 and Smaller: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1-1/2 and Larger: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be the following:

a. McGuire pre-insulated trap and supply covers.

END OF SECTION 22 07 19

SECTION 22 16 16
CONDENSATE DRAIN PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.

2. Specialty pipe fittings.

B. Related Sections:

1. Section 221619 “Condensate Drain Piping Specialties" for sanitary sewerage piping and structures outside the building.

1.03 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.04 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:

1. C.C.R., Title 24, Part 5 (2019 CPC).

2. 2019 California Plumbing Code.

3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.

4. National Fire Protection Association.

5. California Division of the State Architect.

6. California State Division of Industrial Safety.

7. County Health Department.

8. Any other legally constituted body-having jurisdiction thereof.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.05 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Single-Wall Piping Pressure Rating: 10-foot head of water.

A. Delegated Design: Design seismic restraints for aboveground piping, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.06 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.07 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.08 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.09 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.10 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.11 SUBMITTAL DATA

A. Submittal Requirements:

1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.

2. Manufacturers’ submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.

3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.

4. To be valid, all submittals must:

a. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer’s review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.

b. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.

c. Include all pertinent construction, installation, performance and technical data.

d. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.

2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

e. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

a. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled “SPECIFIED ITEM, NOT SUBMITTED”. Product data sheets for the corresponding proposed substitution item shall be clearly labeled “PROPOSED SUBSTITUTION”.

b. Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor’s responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.

3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.

4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.

5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.12 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.13 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.14 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of sanitary waste service.

2. Do not proceed with interruption of sanitary waste service without Architect's written permission.

1.15 UNINSPECTED WORK

A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.

B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.16 RECORD DRAWINGS (Also see General Conditions)

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.17 GUARANTEES (Also see General Conditions)

A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Indirect Waste Piping.

1. Shall be Type "L" copper as specified for water piping.

C. Air Conditioning Condensate Drain Piping.

1. Shall be Type "M" copper as specified for water piping.

2.02 COPPER TUBE AND FITTINGS:

A. Hard Copper Tube: ASTM B 88, Type M tube, drawn temper.

B. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

C. Copper Unions:

1. MSS SP-123.

2. Cast-copper-alloy, hexagonal-stock body.

3. Ball-and-socket, metal-to-metal seating surfaces.

4. Solder-joint or threaded ends

2.03 SPECIALTY PIPE FITTINGS

A. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

2. Dielectric Unions:

a. Manufacturers: Subject to compliance with requirements, provide products by the following:

1) Wilkins; a Zurn company.

b. Description:

1) Standard: ASSE 1079.

2) Pressure Rating: 150 psig.

3) End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.01 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of condensate drain piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install condensate drain piping with 1 percent slope downward toward drain.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping at indicated slopes.

G. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Install unions in copper tubing at connection to each piece of equipment, machine, and specialty.

L. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

M. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.02 JOINT CONSTRUCTION

A. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

B. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

3.03 SPECIALTY PIPE FITTING INSTALLATION

A. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

3.04 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.

2. Individual, Straight, Horizontal Piping Runs:

a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.

b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.

c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

4. Base of Vertical Piping: MSS Type 52, spring hangers

5. Vertical Piping: MSS Type 8 or Type 42, clamps.

6. Install individual, straight, horizontal piping runs:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.

   c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 72 inches with 3/8-inch rod.

2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.05 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect drainage and vent piping to the following:

1. Plumbing Specialties: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.

2. Install test tees (wall cleanouts) in conductors near floor.

3. Equipment: Connect drainage piping as indicated. Provide union for each connection.

C. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

D. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

3.06 IDENTIFICATION

A. Identify exposed condensate drain piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.07 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.

2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.

d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill condensate drain piping. Check components to determine that they are not air bound and that piping is full of water.

b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

d. Cap and subject piping to static water pressure of 50 psig. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

f. Prepare reports for tests and for corrective action required.

B. Condensate drain piping will be considered defective if it does not pass tests and inspections

C. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

D. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

3.08 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.09 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, condensate drain piping NPS 2 and smaller, shall be the following:

1. Hard copper tube, ASTM B 88, Type M copper, soilder-joint fittings; and soldered joints.

END OF SECTION 22 16 16

SECTION 230529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.

2. Trapeze pipe hangers.

3. Metal framing systems.

4. Thermal-hanger shield inserts.

5. Fastener systems.

6. Pipe stands.

7. Equipment supports.

B. Related Sections:

1. Section 233113 "Metal Ducts" for duct hangers and supports.

1.03 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

3. Design seismic-restraint hangers and supports for piping and equipment.

1.05 ACTION SUBMITTALS

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

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.

2. Metal framing systems.

3. Fiberglass strut systems.

4. Pipe stands.

5. Equipment supports.

1.06 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.07 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.

3. Nonmetallic Coatings: Plastic coating, jacket, or liner.

4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.

2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.02 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.

b. Cooper B-Line, Inc.

c. Flex-Strut Inc.

d. GS Metals Corp.

e. Thomas & Betts Corporation.

f. Unistrut Corporation; Tyco International, Ltd.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.

3. Standard: MFMA-4.

4. Channels: Continuous slotted steel channel with inturned lips.

5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

7. Metallic Coating: Electroplated zinc.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.

b. Cooper B-Line, Inc.

c. Flex-Strut Inc.

d. GS Metals Corp.

e. Thomas & Betts Corporation.

f. Unistrut Corporation; Tyco International, Ltd.

2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.

3. Standard: Comply with MFMA-4.

4. Channels: Continuous slotted steel channel with inturned lips.

5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

7. Coating: Zinc.

2.04 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.05 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, **zinc-coated** steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.06 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

2. Base: Plastic.

3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.

4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

2. Bases: One or more; plastic.

3. Vertical Members: Two or more protective-coated-steel channels.

4. Horizontal Member: Protective-coated-steel channel.

5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.07 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.08 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.

E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

F. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, **NPS 2-1/2** and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

O. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

   b. NPS 4: 12 inches long and 0.06 inch thick.

   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.

   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.

4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.

6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.

7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.

11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.

12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.

13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.

16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.

18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.

19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

6. C-Clamps (MSS Type 23): For structural shapes.

7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.

8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.

11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.

    b. Medium (MSS Type 32): 1500 lb.

    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.

2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.

4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.

6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.

8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.

    b. Vertical (MSS Type 55): Mounted vertically.

    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.
5. Stencils.
6. Valve tags.
7. Warning tags.

1.03 ACTION SUBMITTALS

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

B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

C. Valve numbering scheme.

D. Valve Schedules: For each piping system to include in maintenance manuals.

1.04 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

2. Letter Color: White.

3. Background Color: Black.

4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7. Fasteners: Stainless-steel self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's unique equipment number.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, manufacturer, model number, and identify Drawing numbers where equipment is indicated (plans, details, and

schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.03 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches high.

2.04 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

E. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

F. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches high.

2.05 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.06 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.

2. Fasteners: Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."

4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.03 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in other sections.

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Refrigerant Piping:

a. Background Color: Orange.

b. Letter Color: Black.

3.04 DUCT LABEL INSTALLATION

A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.

2. Yellow: For hot-air supply ducts.

3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.

4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.05 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. All Valve-Tags: 1-1/2 inches minimum, round.

2. Valve-Tag Color:

a. All Valve-Tags: Natural.

3. Letter Color:

a. All Valve-Tags: Black.

3.06 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

b. Variable-air-volume systems.

2. Balancing Hydronic Piping Systems:

a. Constant-flow hydronic systems.

b. Variable-flow hydronic systems.

c. Primary-secondary hydronic systems.

1.03 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. TAB: Testing, adjusting, and balancing.

C. TAB Specialist: An entity engaged to perform TAB Work.

1.04 ACTION SUBMITTALS

A. LEED Submittals:

1. Air-Balance Report for Prerequisite IEQ 1: Documentation of work performed for ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

2. TAB Report for Prerequisite EA 2: Documentation of work performed for ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Certified TAB reports.

E. Sample report forms.

F. Instrument calibration reports, to include the following:

1. Instrument type and make.

2. Serial number.

3. Application.

4. Dates of use.

5. Dates of calibration.

1.06 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC.

2. TAB Technician: Employee of the TAB contractor and who is certified by AABC as a TAB technician.

B. TAB Conference: Meet with Architect on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items:

a. The Contract Documents examination report.

b. The TAB plan.

c. Coordination and cooperation of trades and subcontractors.

d. Coordination of documentation and communication flow.

C. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.

2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard TAB contractor's forms approved by Architect.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

F. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

G. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.07 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.08 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 233113 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.

2. Hydronic systems are filled, clean, and free of air.

3. Automatic temperature-control systems are operational.

4. Equipment and duct access doors are securely closed.

5. Balance, smoke, and fire dampers are open.

6. Isolating and balancing valves are open and control valves are operational.

7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.

8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, and SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.

2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."

3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

   a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

   a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.

   b. Measure static pressure directly at the fan outlet or through the flexible connection.

   c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.

   d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

   a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.

5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.

7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.

3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.

2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.06 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.

2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.

3. Measure total system airflow. Adjust to within indicated airflow.

4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.

5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

    a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.

8. Record final fan-performance data.

C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Balance variable-air-volume systems the same as described for constant-volume air systems.

2. Set terminal units and supply fan at full-airflow condition.

3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.

4. Readjust fan airflow for final maximum readings.

5. Measure operating static pressure at the sensor that controls the supply fan if one is installed, and verify operation of the static-pressure controller.

6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.

7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.

8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

    a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

D. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.

2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.

3. Set terminal units at full-airflow condition.

4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.

5. Adjust terminal units for minimum airflow.

6. Measure static pressure at the sensor.

7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

3.07 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.

2. Check liquid level in expansion tank.

3. Check makeup water-station pressure gage for adequate pressure for highest vent.

4. Check flow-control valves for specified sequence of operation, and set at indicated flow.

5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.

6. Set system controls so automatic valves are wide open to heat exchangers.

7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.

8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.08 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.

    a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Architect and comply with requirements in Section 232123 "Hydronic Pumps."

2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.

    a. Monitor motor performance during procedures and do not operate motors in overload conditions.

3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.

4. Report flow rates that are not within plus or minus 10 percent of design.

B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.

C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.

D. Set calibrated balancing valves, if installed, at calculated presettings.

E. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

1. Determine the balancing station with the highest percentage over indicated flow.

2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.

3. Record settings and mark balancing devices.

H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.

J. Check settings and operation of each safety valve. Record settings.

3.09 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.010 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS

A. Balance the primary circuit flow first and then balance the secondary circuits.

3.011 PROCEDURES FOR STEAM SYSTEMS

A. Measure and record upstream and downstream pressure of each piece of equipment.

B. Measure and record upstream and downstream steam pressure of pressure-reducing valves.

C. Check settings and operation of automatic temperature-control valves, self-contained control valves, and pressure-reducing valves. Record final settings.

D. Check settings and operation of each safety valve. Record settings.

E. Verify the operation of each steam trap.

3.012 PROCEDURES FOR HEAT EXCHANGERS

A. Measure water flow through all circuits.

B. Adjust water flow to within specified tolerances.

C. Measure inlet and outlet water temperatures.

D. Measure inlet steam pressure.

E. Check settings and operation of safety and relief valves. Record settings.

3.013 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.

2. Motor horsepower rating.

3. Motor rpm.

4. Efficiency rating.

5. Nameplate and measured voltage, each phase.

6. Nameplate and measured amperage, each phase.

7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.014 PROCEDURES FOR CHILLERS

A. Balance water flow through each evaporator and condenser to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:

1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.

2. For water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.

3. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.

4. Power factor if factory-installed instrumentation is furnished for measuring kilowatts.

5. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatts.

6. Capacity: Calculate in tons of cooling.

7. For air-cooled chillers, verify condenser-fan rotation and record fan and motor data including number of fans and entering- and leaving-air temperatures.

3.015 PROCEDURES FOR COOLING TOWERS

A. Shut off makeup water for the duration of the test, and verify that makeup and blowdown systems are fully operational after tests and before leaving the equipment. Perform the following tests and record the results:

1. Measure condenser-water flow to each cell of the cooling tower.

2. Measure entering- and leaving-water temperatures.

3. Measure wet- and dry-bulb temperatures of entering air.

4. Measure wet- and dry-bulb temperatures of leaving air.

5. Measure condenser-water flow rate recirculating through the cooling tower.

6. Measure cooling-tower spray pump discharge pressure.

7. Adjust water level and feed rate of makeup water system.

8. Measure flow through bypass.

3.016 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.017 PROCEDURES FOR BOILERS

A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.

B. Steam Boilers: Measure and record entering-water temperature and flow and leaving-steam pressure, temperature, and flow.

3.018 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.

2. Water flow rate.

3. Water pressure drop.

4. Dry-bulb temperature of entering and leaving air.

5. Wet-bulb temperature of entering and leaving air for cooling coils.

6. Airflow.

7. Air pressure drop.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.

2. Airflow.

3. Entering- and leaving-air temperature at full load.

4. Voltage and amperage input of each phase at full load and at each incremental stage.

5. Calculated kilowatt at full load.

6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.

2. Airflow.

3. Air pressure drop.

4. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.

2. Wet-bulb temperature of entering and leaving air.

3. Airflow.

4. Air pressure drop.

5. Refrigerant suction pressure and temperature.

3.019 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.

2. Measure motor voltage and amperage. Compare the values to motor nameplate information.

3. Check the refrigerant charge.

4. Check the condition of filters.

5. Check the condition of coils.

6. Check the operation of the drain pan and condensate-drain trap.

7. Check bearings and other lubricated parts for proper lubrication.

8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:

1. New filters are installed.

2. Coils are clean and fins combed.

3. Drain pans are clean.

4. Fans are clean.

5. Bearings and other parts are properly lubricated.

6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.

2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.

3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.

4. Balance each air outlet.

3.020 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.

2. Air Outlets and Inlets: Plus or minus 10 percent.

3. Heating-Water Flow Rate: Plus or minus 10 percent.

4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.021 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

3.022 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.

2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.

2. Fan curves.

3. Manufacturers' test data.

4. Field test reports prepared by system and equipment installers.

5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.

2. Name and address of the TAB contractor.

3. Project name.

4. Project location.

5. Architect's name and address.

6. Engineer's name and address.

7. Contractor's name and address.

8. Report date.

9. Signature of TAB supervisor who certifies the report.

10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.

11. Summary of contents including the following:

a. Indicated versus final performance.

b. Notable characteristics of systems.

c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.

13. Data for terminal units, including manufacturer's name, type, size, and fittings.

14. Notes to explain why certain final data in the body of reports vary from indicated values.

15. Test conditions for fans and pump performance forms including the following:

a. Settings for outdoor-, return-, and exhaust-air dampers.

b. Conditions of filters.

c. Cooling coil, wet- and dry-bulb conditions.

d. Face and bypass damper settings at coils.

e. Fan drive settings including settings and percentage of maximum pitch diameter.

f. Inlet vane settings for variable-air-volume systems.

g. Settings for supply-air, static-pressure controller.

h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.

2. Water and steam flow rates.

3. Duct, outlet, and inlet sizes.

4. Pipe and valve sizes and locations.

5. Terminal units.

6. Balancing stations.

7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

a. Unit identification.

b. Location.

c. Make and type.

d. Model number and unit size.

e. Manufacturer's serial number.

f. Unit arrangement and class.

g. Discharge arrangement.

h. Sheave make, size in inches, and bore.

i. Center-to-center dimensions of sheave, and amount of adjustments in inches.

j. Number, make, and size of belts.

k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.

b. Horsepower and rpm.

c. Volts, phase, and hertz.

d. Full-load amperage and service factor.

e. Sheave make, size in inches, and bore.

f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.

b. Total system static pressure in inches wg.

c. Fan rpm.

d. Discharge static pressure in inches wg.

e. Filter static-pressure differential in inches wg.

f. Preheat-coil static-pressure differential in inches wg.

g. Cooling-coil static-pressure differential in inches wg.

h. Heating-coil static-pressure differential in inches wg.

i. Outdoor airflow in cfm.

j. Return airflow in cfm.

k. Outdoor-air damper position.

l. Return-air damper position.

m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.

b. Location.

c. Coil type.

d. Number of rows.

e. Fin spacing in fins per inch o.c.

f. Make and model number.

g. Face area in sq. ft..

h. Tube size in NPS.

i. Tube and fin materials.

j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.

b. Average face velocity in fpm.

c. Air pressure drop in inches wg.

d. Outdoor-air, wet- and dry-bulb temperatures in deg F.

e. Return-air, wet- and dry-bulb temperatures in deg F.

f. Entering-air, wet- and dry-bulb temperatures in deg F.

g. Leaving-air, wet- and dry-bulb temperatures in deg F.

h. Water flow rate in gpm.

i. Water pressure differential in feet of head or psig.

j. Entering-water temperature in deg F.

k. Leaving-water temperature in deg F.

l. Refrigerant expansion valve and refrigerant types.

m. Refrigerant suction pressure in psig.

n. Refrigerant suction temperature in deg F.

o. Inlet steam pressure in psig.

G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.

b. Location.

c. Make and type.

d. Model number and unit size.

e. Manufacturer's serial number.

f. Fuel type in input data.

g. Output capacity in Btu/h.

h. Ignition type.

i. Burner-control types.

j. Motor horsepower and rpm.

k. Motor volts, phase, and hertz.

l. Motor full-load amperage and service factor.

m. Sheave make, size in inches, and bore.

n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.

b. Entering-air temperature in deg F.

c. Leaving-air temperature in deg F.

d. Air temperature differential in deg F.

e. Entering-air static pressure in inches wg.

f. Leaving-air static pressure in inches wg.

g. Air static-pressure differential in inches wg.

h. Low-fire fuel input in Btu/h.

i. High-fire fuel input in Btu/h.

j. Manifold pressure in psig.

k. High-temperature-limit setting in deg F.

l. Operating set point in Btu/h.

m. Motor voltage at each connection.

n. Motor amperage for each phase.

o. Heating value of fuel in Btu/h.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.

b. Location.

c. Make and type.

d. Model number and size.

e. Manufacturer's serial number.

f. Arrangement and class.

g. Sheave make, size in inches, and bore.

h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.

b. Horsepower and rpm.

c. Volts, phase, and hertz.

d. Full-load amperage and service factor.

e. Sheave make, size in inches, and bore.

f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.

b. Total system static pressure in inches wg.

c. Fan rpm.

d. Discharge static pressure in inches wg.

e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.

b. Location and zone.

c. Traverse air temperature in deg F.

d. Duct static pressure in inches wg.

e. Duct size in inches.

f. Duct area in sq. ft..

g. Indicated air flow rate in cfm.

h. Indicated velocity in fpm.

i. Actual air flow rate in cfm.

j. Actual average velocity in fpm.

k. Barometric pressure in psig.

J. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.

b. Location and zone.

c. Apparatus used for test.

d. Area served.

e. Make.

f. Number from system diagram.

g. Type and model number.

h. Size.

i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.

b. Air velocity in fpm.

c. Preliminary air flow rate as needed in cfm.

d. Preliminary velocity as needed in fpm.

e. Final air flow rate in cfm.

f. Final velocity in fpm.

g. Space temperature in deg F.

K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling-unit identification.

b. Location and zone.

c. Room or riser served.

d. Coil make and size.

e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.

b. Entering-water temperature in deg F.

c. Leaving-water temperature in deg F.

d. Water pressure drop in feet of head or psig.

e. Entering-air temperature in deg F.

f. Leaving-air temperature in deg F.

L. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

a. Unit identification.

b. Location.

c. Service.

d. Make and size.

e. Model number and serial number.

f. Water flow rate in gpm.

g. Water pressure differential in feet of head or psig.

h. Required net positive suction head in feet of head or psig.

i. Pump rpm.

j. Impeller diameter in inches.

k. Motor make and frame size.

l. Motor horsepower and rpm.

m. Voltage at each connection.

n. Amperage for each phase.

o. Full-load amperage and service factor.

p. Seal type.

2. Test Data (Indicated and Actual Values):

a. Static head in feet of head or psig.

b. Pump shutoff pressure in feet of head or psig.

c. Actual impeller size in inches.

d. Full-open flow rate in gpm.

e. Full-open pressure in feet of head or psig.

f. Final discharge pressure in feet of head or psig.

g. Final suction pressure in feet of head or psig.

h. Final total pressure in feet of head or psig.

i. Final water flow rate in gpm.

j. Voltage at each connection.

k. Amperage for each phase.

M. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.

b. Serial number.

c. Application.

d. Dates of use.

e. Dates of calibration.

3.023 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.

2. Check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.

b. Measure water flow of at least 5 percent of terminals.

c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.

d. Verify that balancing devices are marked with final balance position.

e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.

2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect.

3. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.

2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.024 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230719

HVAC PIPING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Condensate drain piping, indoors and outdoors.

2. Chilled-water piping, indoors and outdoors.

3. Heating hot-water piping, indoors and outdoors.

4. Refrigerant suction and hot-gas piping, indoors and outdoors.

B. Related Sections:

1. Section 230713 "Duct Insulation."

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.

2. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.

2. Detail attachment and covering of heat tracing inside insulation.

3. Detail insulation application at pipe expansion joints for each type of insulation.

4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.

5. Detail removable insulation at piping specialties.

6. Detail application of field-applied jackets.

7. Detail application at linkages of control devices.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.07 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.08 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aerocel.

b. Armacell LLC; AP Armaflex.

c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Fibrex Insulations Inc.; Coreplus 1200.

b. Johns Manville; Micro-Lok.

c. Knauf Insulation; 1000-Degree Pipe Insulation.

d. Manson Insulation Inc.; Alley-K.

e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

H. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; CrimpWrap.

b. Johns Manville; MicroFlex.

c. Knauf Insulation; Pipe and Tank Insulation.

d. Manson Insulation Inc.; AK Flex.

e. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.02 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Ramco Insulation, Inc.; Super-Stik.

2.03 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aeroseal.

b. Armacell LLC; Armaflex 520 Adhesive.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.

d. K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.

b. Eagle Bridges - Marathon Industries; 225.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.

d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.

b. Eagle Bridges - Marathon Industries; 225.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.

d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.04 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.

b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.

4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.

5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.

b. Eagle Bridges - Marathon Industries; 550.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.

d. Mon-Eco Industries, Inc.; 55-50.

e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.

4. Solids Content: 60 percent by volume and 66 percent by weight.

5. Color: White.

2.05 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.

   b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.

   c. Vimasco Corporation; 713 and 714.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.

4. Service Temperature Range: 0 to plus 180 deg F.

5. Color: White.

2.06 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

   b. Eagle Bridges - Marathon Industries; 405.

   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.

   d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250 deg F.

5. Color: Aluminum.

6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250 deg F.

5. Color: White.

6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile

Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.07 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.08 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.

b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.

c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Factory cut and rolled to size.

b. Finish and thickness are indicated in field-applied jacket schedules.

c. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.

d. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.

2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.

3) Tee covers.

4) Flange and union covers.

5) End caps.

6) Beveled collars.

7) Valve covers.

8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.09 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 428 AWF ASJ.

b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.

c. Compac Corporation; 104 and 105.

d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.

3. Thickness: 11.5 mils.

4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch in width.

7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 491 AWF FSK.

b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.

c. Compac Corporation; 110 and 111.

d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.

3. Thickness: 6.5 mils.

4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch in width.

7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.010 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

a. ITW Insulation Systems; Gerrard Strapping and Seals.

b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, galvanized steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. C & F Wire.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.

2. Verify that surfaces to be insulated are clean and dry.

3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at [2 inches] [4 inches] o.c.

a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.

2. Testing agency labels and stamps.

3. Nameplates and data plates.

4. Manholes.

5. Handholes.

6. Cleanouts.

3.04 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.05 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.06 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.

2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.07 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.

4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

4. Install insulation to flanges as specified for flange insulation application.

3.08 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.

2. Install lap or joint strips with same material as jacket.

3. Secure jacket to insulation with manufacturer's recommended adhesive.

4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.

5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.09 FINISHES

A. Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.010 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.011 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.

2. Underground piping.

3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.012 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch thick.

B. Chilled Water:

1. Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe, Type I: 1 inch thick.

C. Heating-Hot-Water Supply and Return:

1. Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick.

D. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch thick.

3.013 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Chilled Water:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 3 inches thick.

B. Heating-Hot-Water Supply and Return:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

C. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 2 inches thick.

3.014 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Loose-fill insulation, for belowground piping, is specified in Section 232113.13 "Underground Hydronic Piping".

3.015 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:

1. None.

3.016 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:

1. Painted Aluminum, Corrugated: 0.024 inch thick.

3.017 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 230719

SECTION 230922

CLIMATE MANAGEMENT CONTROL FOR HVAC

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are part of this specification and shall be used in conjunction with this section as part of the contract documents. Consult the above for further instructions pertaining to this work. The Contractor is bound by the provisions of Division 0 and Division 1.

1.2 CONTROL SYSTEM DESCRIPTIONS

A. The Building Automation System (BAS) shall be as indicated on the drawings and described in these specifications. System shall include a network of commercial Internet-programmable thermostats, their accessories, and any other networked devices required for complete climate management. Devices shall communicate across a wireless network using IEEE 802.15.4 technical standards. Wireless communication shall be of an automated mesh communication type, which self-establishes network addresses, communication routes, and all other setup requirements to establish connection across the entire campus. A single Ethernet-connected Gateway shall be able to connect the wireless mesh network to the Internet, allowing for climate management through a cloud based web-application. This network design is to be used to isolate the BAS from the school's private Ethernet network (LAN) and/or WiFi networks. IEEE 802.11 or any other wireless standard of communication or a wired network communication protocol between devices is not acceptable by these BAS specifications. The Gateway is to connect to a single outbound Ethernet connection on the owner's wide area network (WAN) over a TCP/IP connection. The owner's firewall shall not require any inbound port assignments for the Gateway to connect to the cloud servers. The Gateway shall not require a Public IP and it shall not run any standard available operating systems, such as Windows or Linux, for security purposes.

B. Access and control of BAS shall be through a web-based graphical management platform. The BAS platform shall sit on a cloud server and be accessible on both local personal computers and remotely by use of a web-browser that supports HTML5 or later.

C. No on-site servers are to be installed or used for the BAS. No software licensing fees or future software licensing fees shall be required as part of the BAS. These specifications and guidelines are to create a cohesive and secure network that provides full management over the facility's climate through the cloud BAS.

D. The BAS shall accommodate an unlimited simultaneous multiple-user operation. Access to the BAS shall be limiting based on security permissions of each operator's role managed by owner site Administrators.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 APPROVED BUILDING AUTOMATION SYSTEM MANUFACTURERS

A. Shop drawings and manufacturer's standard specification data sheets on all hardware shall be provided for this project. No work may begin on any segment of this project until the Engineer and Owner have reviewed submittals for conformity with the plan and specifications.

B. Shop drawings shall include basic floor plans depicting locations of all equipment and wiring (installed by others) to be controlled by system and locations of thermostats, gateways, and other equipment provided under this section. Drawings shall also show location of electrical power, low voltage wiring and data ports, provided by others, required for proper installation of systems of this section.

C. Submit PDF submittal data and shop drawings to the Engineer for review prior to ordering or fabrication of the equipment. The Contractor prior to submitting shall check all documents for accuracy.

D. The Engineer will make corrections, if required, and return to the Contractor. The Contractor will then resubmit with the corrected or additional data. This procedure shall be repeated until all corrections are made to the satisfaction of the Engineer and the submittals are fully approved.

1.5 SYSTEM STARTUP & COMMISSIONING

A. Each BAS component in the system shall be tested for both hardware and software functionality. In addition, each mechanical and electrical system under control of the BAS will be tested against the appropriate sequence of operation specified herein. Documentation shall be provided to the owner that proves installation and testing has been completed and points out any mechanical issues found which are not related to the installation of the BAS. Successful completion of the system tests shall constitute the beginning of the warranty period.

B. The BAS Contractor shall provide all manpower and engineering services required to assist the HVAC Contractor and Balancing Contractor in testing, adjusting, and balancing all systems in the building. The BAS Contractor shall have a trained technician available on request during the balancing of the systems. The BAS Contractor shall coordinate all requirements to provide a complete air balance with the Balancing Contractor and shall include all labor and materials in his contract to assist with functional testing of system as it relates to the BAS.

C. Upon completion of installation, submit three (3) copies of record documents. The documents shall be submitted for approval prior to final completion and include:

1. Testing and Commissioning Reports and Checklists signed off by trained field commissioning personnel.
2. Name, address and telephone number of Contractor personnel managing and installing equipment, along with service personnel responsible for supporting the ongoing warranty and services of the control system.
3. Procedures for operating the BAS, including logging on/off, alarm management, reading reports, trends, modification of setpoints, scheduling, and other interactive system requirements.
4. Provide information on how to receive support from Pelican Wireless Systems and communicate that they are a direct supporting resource. Contact information for Technical Support from Pelican Wireless Systems is to be provided.

1.6 CODES AND STANDARDS

A. Codes and Standards. Meet requirements of all applicable standards and codes, except when more detailed or stringent requirements are indicated by the Contract Documents, including requirements of this Section:

1. California 2019 Title 24 Compliant
2. California Energy Commission Occupant Control Smart Thermostat (OCST) certified
3. OpenADR 2.0 certified

1.7 TRAINING

A. The BAS Contractor shall provide training for two (2) owner representatives and/or maintenance personnel. The BAS Contractor shall provide on-site training to the District’s representative(s) and maintenance personnel per the following description:

B. On-site training shall consist of a minimum of (1) hours, as indicated above of hands-on instruction geared at the operation and maintenance of the systems. The curriculum shall include:

1. System Overview
2. System Application and Operation
3. System Access
4. Application Features Overview
5. Changing Set Points and other attributes
6. Scheduling
7. Editing configurable variables
8. Graphics
9. Viewing Historical Reports
10. Operation sequences including start-up, shutdown, adjusting and balancing
11. Equipment maintenance

1.8 OPERATING AND MAINTENANCE MANUALS

A. The operation and maintenance manuals shall contain all information necessary for the operation, maintenance, replacement, installation, and parts procurement for the entire BAS.

B. Following project completion and testing, the BAS contractor will submit as-built documentation reflecting the exact installation of the system.

1.9 WARRANTY

A. The BAS contractor shall warrant the system for 12 months after system acceptance and beneficial use by the owner. During the warranty period, the BAS contractor shall be responsible for all necessary revisions as required to provide a complete and workable system consistent with the letter and intent of the Sequence of Operation section of the specification. BAS equipment shall include a limited-warranty by the manufacturer for a period of five (5) years from the time of system acceptance.

B. Limited-warranty by manufacturer is limited to replacement of defective products.

1.10 WORK BY OTHERS

A. The BAS Contractor shall coordinate with other contractors prior to performing the work on this project and cooperate as necessary to achieve a complete and neat installation. To that end, each contractor shall consult the drawings and specifications for all trades to determine the nature and extent of others' work prior to fabrication and installation. The owner's representative shall be immediately notified if an area of conflict occurs between trades prior to fabrication and installation. BAS Contractor shall provide field supervision to the Mechanical Contractor for pre-installation of control components.

B. Low-voltage thermostat wiring between equipment and thermostat locations shall be furnished and installed by others. Unless otherwise noted all new low-voltage wiring shall be multiple conductor thermostat wiring (wire count as indicated in Thermostat Manufacturer's Installation Instructions) installed per owner's specifications. (Wiring in existing installations shall be

minimum three (3) conductor/18-gauge wires per BAS manufacturer's standard specifications, multiple conductor/18-gauge thermostat wiring preferred - see Installation Instructions for specific conductor counts depending on heating and cooling modes of existing equipment.)

C. Related work provided by others:

1. 110V outlets shall be provided within five (5) feet of each Gateway or Wireless Repeater location.
2. One (1) Ethernet data port shall be provided within ten (10) feet of each Gateway location.

D. Equipment start-up and servicing.

1.11 SCOPE OF WORK

A. Except where otherwise noted, the system shall consist of a network of commercial Internet-programmable thermostats, their accessories, and any other networked climate management device(s) required to fill the intent of the specification, sequence of operations, and provide for a complete and operable system.

B. The BAS contractor shall review and study existing building/site conditions where applicable and all new construction drawings for the project including HVAC drawings and the entire project specifications to familiarize themselves with the equipment and system operation prior to bidding and submittal of a bid/price and notify the owner immediately of any conflicts between the project and the scope of work of this section, including work to be completed by others.

C. All equipment and installation of control devices associated with the equipment listed below shall be provided under this BAS contractor.

D. When the BAS is fully installed and operational, the BAS contractor will make themselves available to meet with the designated representatives of the owner to review the as-installed condition of the system. At that time, the BAS contractor shall demonstrate the operation of the system and prove that it complies with the intent of the drawings and specifications.

E. The BAS contractor shall furnish and install a complete BAS control system, including all necessary hardware and all operating and applications software necessary to perform the control sequences of operation as called for in this specification.

F. Provide and install BAS controls for the HVAC Equipment as noted on the drawings.

G. Provide technical support necessary for commissioning of system in coordination with the HVAC Contractor, Balancing Contractor, and the owner's team.

H. Shall provide one training session in the operation of the system for owner's personnel.

I. All work performed under this section of the specifications will be in compliance with all codes and regulations as mandated by the authority having jurisdiction.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Unless otherwise noted, all product shall be of a single manufacturer. The standard of design and quality shall be products as manufactured by Pelican Wireless Systems.

2.2 COMMUNICATION

A. This project shall be compromised of a network of devices that use an IEEE 802.15.4 self-creating and self-healing wireless mesh communication network to reach an Ethernet Gateway.

B. The Gateway shall communicate to cloud servers via a single Ethernet connection at the owner's wide area network (WAN) over a TCP/IP connection. The facility's firewall shall not require any inbound port assignments for the Gateway to connect to the cloud servers. The Gateway shall not require a Public IP.

C. No BACnet, modBus, LON, or any other device-to-device wired communication protocol shall be used in the communication network.

2.3 OPERATOR INTERFACE

A. The BAS shall be controlled, managed, and configured using a Web-App on any personal computer, smartphone, and/or tablet that runs a browser with HTML5 or newer.

B. The Web-App platform shall run on cloud servers which allow for virtual access. Platform shall not run on a local on-site server.

C. The Web-App shall support at a minimum, the following functions:

1. Personal user log-on identifications (email addresses) and unique passwords shall be required.
2. Custom HTML programming shall not be required to display any graphics, data, or build the Web-App. There shall be no development cost, commissioning costs, or software upgrade cost required to obtain and use the Web-App.
3. Storage of historical data shall reside on the cloud server and shall not sit within the client's computer, internal network, or other devices. A BAS, which requires on-site data storage, is not acceptable.

4. System shall allow for administrator and user defined access privileges.
5. A Push/Pull OpenAPI interface with XML data output shall be available.
6. Servers shall not run a Windows operating system.

D. Control and Override

1. The BAS shall provide view, override, and edit of the status of any object and property in the system. The status of the device shall be defined graphically and shall not require any custom programs or programming.
2. Temporary Overrides. The BAS shall be able to provide temporary override (wherever an override is allowed) and automatically remove the override after a specified period of time.
3. Any override and edit of a object virtually or at the device, if allowable, shall be historically tracked.

E. Scheduling

1. The BAS shall provide users with scheduling of application devices through a graphical interface. Scheduling shall include, but is not limited to:
   a. Occupied/Unoccupied Schedules. Shall allow 12 scheduled set-time changes in a single day, be configurable for Daily, Weekly, and Weekday/Weekend layouts, and shall be able to be unique to individual devices or easily shared between multiple devices, where applicable.
   b. Event Schedules. Shall allow for advanced one-time or repeating event type schedules. Event schedules shall override Occupied/Unoccupied Schedules. After the Event schedule ends, the device shall revert back to the Occupied/Unoccupied Schedule automatically.
   c. Vacation Schedules. A 360-day Calendar shall provide override of schedules during vacation days. Thermostats shall be able to automatically or be manually switched to follow Vacation Schedules instead of Occupied/Unoccupied Schedules.

F. Alarm Notification

1. Alarm Notification(s) shall be generated if there are failures detected by devices part of the BAS. These failures shall be, but are not limited to: temperature deviations, temperatures missing targets, temperatures too high or too low, failures of equipment, etc. Alarm Notification(s) shall be posted on the BAS and shall be able to be sent either via email or text message to an unlimited number of users.

G. Reports and Logs

1. Data shall be logged and stored on cloud servers for all devices part of BAS in real-time. Every device real-time “state change”, when applicable, shall be stored
   a. Each space temperature
   b. Each temperature set point(s)
   c. Each current call: heat, cool, number of stages, fan, economizer, etc.
   d. Each damper position
   e. Each valve position
   f. Each CO_2 change
   g. Each CO_2 setting
   h. Each current call for ventilation due to high CO_2

i. Each Humidity change
j. Each Humidity set point
k. Each current call for dehumidification or humidification.
l. Each Fan speed adjustment
m. Supply duct static pressure
n. Supply, Return, Outside air temperatures

2. Data shall be represented on historical graphs that allow for easy viewing of device state change at different times.
3. Excel outputs shall not be required to view data. Historical data shall be viewable through BAS.

2.4 APPLICATION-SPECIFIC CONTROLLERS

A. Application Specific Controllers shall not require custom programming and shall control specific equipment through simple configuration settings done through the cloud-based BAS. All configuration changes shall automatically upload into the device once set on the BAS and shall be stored by the device's internal memory.

B. Gateways are devices which connected to an Ethernet port and act as a bridge between the BAS cloud servers and the wireless mesh network.

1. Shall be capable of providing Internet connection to up to 2,000 devices.
2. Shall be capable of automatically addressing routing tables to all devices part of wireless mesh network and shall not require manual programming or addressing.
3. Shall communicate to cloud servers over a TCP/IP outbound-only connection
4. Shall not require a Public IP address, custom VPNs, or any on-site servers.
5. Shall communicate to other BAS devices over the dedicated and isolated 802.15.4 IEEE technical standard.
6. Shall be secured using AES (Advanced Encryption Standards).

C. Internet-Enabled Thermostats are controllers which detect a space/zone temperature and operate equipment or dampers which supply heating, cooling, ventilation, or a combination of the three mechanical states, to their space/zone. Examples are thermostats for VAV, VVT, Fan-Powered Boxes, Fan Coil, Blower Coils, Unit Ventilators, Heat Pumps, Water Source Heat Pumps, and Conventional DX and/or Gas heat equipment.

1. Shall be capable of providing 24VAC outputs which can be configured to provide control of the following: two stages of fan, three stages of cooling, two stages of heating, one stage of auxiliary heat (heat pumps), floating point zone dampers, two position zone dampers, floating point zone reheat valves, and two position zone reheat valves
2. Shall include a removable wiring terminal module that allows for thermostat installation even in situations where there are only three wires between equipment and where the thermostat is to be installed.

3. Shall be available with the following internal sensors: temperature only, temperature and humidity, temperature, humidity, and CO^2, and temperature and CO^2. All sensors required by the specifications are to be internal to the thermostat and not require two devices on the wall.
4. Shall be able to accept expansion accessories that allow for more advanced control sequences, and additional temperature detection. Examples are economizer controllers, outside air ventilation control, supply air temperature
5. Shall communicate with the wireless mesh network through an internal wireless antenna that runs on the 802.15.4 technical standards.
6. Shall be able to automatically repeat the wireless mesh network to additional devices part of the BAS.
7. Shall automatically push to the BAS all “state changes” so as to be viewable historically and in real-time from BAS. Examples are changes in equipment operation (heat, cool, fan), number of stages active, the temperatures in the space, damper position, valve position, temperature set-points, etc.m
8. Shall be able to lock-out heat pump compressor(s) based on outside air temperature.
9. Shall provide set-point (heat & cool) temperature limitations through BAS.
10. Shall provide full local keypad lock-out from BAS.
11. Shall meet California 2019 Title 24 code standards.
12. Shall have a programmable three (3°F) degree heat/cool temperature range which auto-adjusts to a five (5°F) degree deadband.
13. Shall have both a heat setpoint, cool setpoint, and auto-changeover.
14. Shall have Optimum Start algorithms that will calculate start times based on at least seven (7) days of previous run-time temperature and rate-of-change historical data for its space. Optimum Start algorithm shall recalculate each optimized schedule time before each optimized schedule.
15. Shall be able to be manually overridden through BAS.
16. Shall be configured through BAS.

D. Wired Temperature Inputs are to be available to provide external temperature detection for specific BAS devices. Examples are to provide supply air temperature, water temperature, refrigeration temperature, outside air temperature, etc. to a thermostat or other device.

1. Shall accept 10K type II thermistors.
2. Shall push to the BAS real-time temperature changes so as to be viewable historically and in real-time from the BAS.
3. Shall accept a thermistor at a maximum of up to 100 feet from input terminal.
4. Shall be configured through the BAS.

E. Internet-Enabled Economizer Controller are controllers that modulate an outside air damper to provide ventilation and economization to a single zone.

1. Shall only require a dry-bulb outside air temperature sensor and dry-bulb supply air temperature sensor. No dry-bulb return air temperature sensor or dry-bulb mixing box temperature sensor shall be required.
2. Shall communicate with thermostat to determine space temperature and space temperature setpoint in order to decide when economization can be used.
3. Shall continue to economize as its only source of cooling as long as the outside air temperature is able to keep the space temperature within 1°F of the cool temperature setpoint.
4. Shall be able to enable mechanical cooling at the same time as economization.

5. Shall be able to prevent the supply air temperature from dropping below 56°F during economization.
6. Shall provide enthalpy by use of pulling humidity and barometric pressure information from the Internet based on the zipcode of installation location. Enthalpy shall not require any additional probes other than the dry-bulb probe and shall be free to enable.
7. If connected to a CO^2 thermostat, shall be able to provide demand ventilation control of outside air damper.
8. Shall have a minimum ventilation damper position and a maximum ventilation damper position.
9. Shall be able to be scheduled to not open the outside air damper for ventilation during unoccupied hours.
10. Shall be able to control a Variable Frequency Drive (VFD) with up to five (5) fan speed inputs. Example of fan speed changes are during ventilation, stage one cooling, stage two cooling, stage one heating, stage two heating.
11. Shall modulate an outside air damper by use of a 0-10V DC signal.
12. Shall accept a 0-10VDC signal feedback input from the outside air damper actuator to confirm outside air damper is working correctly.
13. Shall meet all California 2019 Title 24 codes, including Fault Detection and Diagnostic requirements.
14. Shall send Fault Detection and Diagnostic information to the BAS.
15. Shall accept a minimum of three (3) 10K type II thermistors.
16. Shall be able to modulate a 0-10VDC hot water valve for heating and outside air tempering.
17. Shall be able to control a face/bypass damper.
18. Shall push all “state changes” to the BAS as to be viewable historically and in real-time from BAS. Examples are changes in equipment operation (heat, cool, fan, economization, ventilation), number of stages active, the supply air temperature, the return air temperature, hot water valve position, face/bypass damper position, variable speed fan setting, etc.
19. Shall be able to be manually overridden through the BAS.
20. Shall be configured through the BAS.

F. Internet-Enabled Power Relay Module are controllers which have dry-contact relays able to start/stop different electrical equipment. Examples are exhaust fans, lights, pumps, valves, boilers, chillers, etc.

1. Shall have relays with a max rating of 120 VAC @ 15 AMPs or 240/277 VAC @ 10 AMPs.
2. Shall have a low-voltage terminal for momentary contact override inputs. Override time shall be configurable for a specific amount of minutes through a configuration from the BAS.
3. Shall be able to provide Lead/Lag sequencing between relays.
4. Shall be able to accept an external dry-contact input used to verify flow if being used as a pump controller. If being used as a lead/lag pump controller, shall be able to alarm the BAS if flow is not detected when Pump A is enabled and start Pump B as a stand-by pump.
5. Shall communicate with the wireless mesh network through an external wireless antenna that runs on the 802.15.4 technical standards. Antenna shall be able to communicate with Power Relay Module over three (3) 18-gauge wires up to 500 feet between device terminal inputs.
6. Shall be able to automatically repeat the wireless mesh network to additional devices part of the BAS.

7. Shall push all “state changes” to the BAS as to be viewable historically and in real-time from the BAS. Examples are changes in relay positions On or Off.
8. Shall be able to be manually overridden through the BAS.
9. Shall be configured through the BAS.

G. Zone Controllers are controllers which operate equipment which supply heating, cooling and ventilation, or a combination of these mechanical states to multiple zones.

1. Shall communicate with the wireless mesh network through a removable wireless antenna that runs on the 802.15.4 technical standards. Antenna shall be able to communicate to Zone Controller over three (3) 18-gauge wires up to 500 feet between devices terminal inputs.
2. Communication from the Zone Controller to all zone/space Thermostats shall be over the wireless mesh network.
3. Shall be capable of providing 24VAC outputs which can be configured to provide control of the following: multiple stages of fan, multiple stages of cooling, and multiple stages of heating.
4. Shall be capable of providing 0-10VDC outputs which can be configured to provide control of the following: variable speed fan (VFD), modulating outside air damper, modulating heating valve.
5. Shall have integrated outside air damper control logic and not require a third-party or additional controllers to provide economization and ventilation control.
6. Shall directly accept a supply duct static pressure probe. Shall have an integrated short-term and long-term learning PID loop algorithm for maintaining target supply static configurations. PID loop shall not require any type of cost for programming and is to be factory loaded into controller.
7. Shall only require dry-bulb outside, return, and supply air temperature sensors.
8. If communicating to CO^2 thermostat(s), shall be able to provide demand ventilation control of outside air damper.
9. Shall push all “state changes” to the BAS as to be viewable historically and in real-time from the BAS. Examples are changes in equipment operation (heat, cool, fan, economization, ventilation), number of stages active, the supply air temperature, the return air temperature, the outside air temperature, hot water valve position, supply duct static reading, variable speed fan setting, etc.
10. Shall be able to be manually overridden through the BAS.
11. Shall be configured through the BAS.

H. Wireless Proximity Sensors are thermostat accessories which are able to detect when a door or window is opened or closed, or be able to accept a dry-contact input from an occupancy sensor.

1. Shall be able to communicate to a single Internet-Programmable Thermostat over wireless mesh network.
2. Shall communicate with the wireless mesh network through an internal wireless antenna that runs on the 802.15.4 technical standards.
3. Shall run on two AA batteries and not require any unique type of battery to operate.
4. Shall push all “state changes” to the BAS as to be viewable historically and in real-time from the BAS. Examples are if the door is open, if the space is unoccupied, if a window is open.
5. Shall be configured through the BAS.

I. Remote Wireless Sensors are thermostat accessories which are used to either average temperatures between the sensors location and a master thermostat or to relocate the sensing location of the master thermostat without having to run new wire.

1. Shall be able to communicate to a single Internet-Programmable Thermostat over wireless mesh network.
2. Shall communicate with the wireless mesh network through an internal wireless antenna that runs on the 802.15.4 technical standards.
3. Shall run on two AA batteries and not require any unique type of battery to operate.
4. Shall push all “state changes” to the BAS as to be viewable historically and in real-time from the BAS. Examples are changes in equipment operation (heat, cool, fan), number of stages active, the temperatures in the space, temperature set-points, etc.
5. Shall be configured through the BAS.

J. Wireless Repeaters are devices which extend the 802.15.4 wireless mesh network across large expanses or where BAS devices are unable to repeat the wireless mesh network on their own. Examples are when bridging the wireless mesh network from one building to another.

1. Shall communicate with the wireless mesh network through an internal wireless antenna that runs on the 802.15.4 technical standards.
2. Shall be able to automatically repeat the wireless mesh network to additional devices part of the BAS.
3. Shall not require an Ethernet connection or any TCP/IP connection.
4. Shall only require a single 120V outlet for power.

K. Software

1. To meet the sequence of operation for each controller, the controller shall be configured through the BAS by the installing contractor. No custom programming or downloading by use of a service tool shall be required.
2. Stand-Alone Operation: Each piece of equipment specified shall provide stand-alone operation. BAS devices shall not require web connection or communication to the BAS to run under normal operations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The Contract Documents shall be thoroughly examined for coordination of control devices, their installation, wiring, and commissioning. Coordinate and review mechanical equipment specifications, locations, and identify any discrepancies, conflicts, or omissions that shall be reported to the Architect/Engineer for resolution before rough-in work is started.

B. The BAS manufacturer shall be available to provide assistance to BAS Contractor in order to verify that control equipment can be installed as required, and any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.

3.2 PROTECTION

A. The BAS installing contractor shall protect all work and material from damage by their work or personnel, and shall be liable for all damage thus caused.

B. The BAS installing contractor shall be responsible for their work and equipment until final inspection, testing, and acceptance. The BAS installing contractor shall protect their work against theft or damage, and shall carefully store material and equipment received on site that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

C. Installation of BAS shall be performed by an approved Contractor. Approved contractor is one whom either has installed the BAS before and has been approved by the BAS manufacturer. The Contractor shall certify all work as proper and complete. Under no circumstance shall the design, scheduling, coordination, programming, training, and warranty requirements for the project be delegated to a subcontractor without prior written approval of the owner.

D. Demolition. Remove controls which do not remain as part of the BAS. The owner will inform the Contractor of any equipment which is to be removed that will remain the property of the owner. All other equipment which is remove will be disposed of by the Contractor.

E. Access to Site. Unless notified otherwise, entrance to building is restricted. No one will be permitted to enter the building unless their names have been cleared with the owner or an owner-approved representative.

F. Code Compliance. All wiring shall be installed in accordance with all applicable electrical codes and will comply with equipment manufacturer’s recommendations.

G. Clean Up. During installation, contractor shall maintain a clean environment. At the completion of the work, all equipment pertinent to this contract shall be checked and thoroughly cleaned, and all other areas shall be cleaned around equipment provided under this contract.

3.3 WIRING, CONDUIT, AND CABLE

A. All control wires between mechanical equipment and BAS devices are to be furnished and installed by others, unless BAS contractor is responsible for this part of the installation. The BAS contractor shall not begin work on this contract until all wiring is installed to the satisfaction of the BAS contractor.

B. It is not an excuse to have not referenced the manufacturer’s installation documentation or to have contacted the BAS manufacturer if wire installation is not understood and done incorrectly by the installing Contractor.

3.4 HARDWARE INSTALLATION

A. Installation Practices for Devices. All devices are to be mounted level/plumb and per the manufacturer’s installation documentation.

B. It is not an excuse to have not referenced the manufacturer's installation documentation or to have contacted the BAS manufacturer if hardware installation not understood and done incorrectly by the installing Contractor.

C. Identification.

1. Identify all control wires with labeling tape or sleeves using either words, letters, or numbers that can be exactly cross-referenced with as-built drawings.
2. All field enclosures, other than controllers, shall be identified with a nameplate. The lettering shall be in white against a black or blue background.
3. Junction box covers will be marked to indicate that they are a part of the BAS.
4. All field devices (except space sensors) that are not mounted within FIP's shall be identified with name plates.
5. All field devices inside FIP's shall be labeled.

D. Existing Controls. Existing controls are not to be reused. All BAS devices will be new.

E. Control System Switch-Over. The installing contractor shall minimize control system downtime during switch-over. Sufficient installation mechanics will be on-site so that the entire switch-over can be accomplished in a reasonable time frame.

F. Location.

1. The location of sensors is as indicated in the mechanical and architectural drawings.
2. Space temperature, humidity, and CO^2 sensors will be mounted away from machinery generating heat, direct light, and/or diffuser air streams.
3. If external temperature sensors are installed, sensors will be mounted away from machinery generating heat, direct light, and/or diffuser air streams.
4. If outdoor air temperature sensors are installed, sensors are to be installed such that the effects of heat radiated from the building or sunlight is minimized.

3.5 SYSTEM CONFIGURATION

A. General. The installing contractor shall provide all labor necessary to install, initialize, start-up and troubleshoot all system hardware and configurations described in this section. This includes any requirements necessary to access the web application on third-party devices.

B. Installing contractor shall work with owner's representative to determine configuration parameters including but not limited to hours of operation, set points, system variables, naming of devices, and site naming. Naming of devices and the site shall be performed by the installing contractor. Naming convention of space thermostats shall be space served. Naming convention of zone controllers shall be the equipment serial number. All naming shall be provided by or agreed upon with the owner.

3.6 SYSTEM COMMISSIONING AND SYSTEM STARTUP

A. Each BAS component in the system shall be tested for both hardware and software functionality. In addition, each mechanical and electrical system under control of the BAS will be tested against the appropriate sequence of operation specified herein. Documentation shall be provided to the owner that proves installation and testing has been completed and points out any mechanical issues found that are not related to the installation of the BAS. Successful completion of the system tests shall constitute the beginning of the warranty period.

B. The BAS Contractor shall provide all manpower and engineering services required to assist the HVAC Contractor and Balancing Contractor in testing, adjusting, and balancing all systems in the building. The BAS Contractor shall have a trained technician available on request during the balancing of the systems. The BAS Contractor shall coordinate all requirements to provide a complete air balance with the Balancing Contractor and shall include all labor and materials in his contract to assist with functional testing of system as it relates to BAS.

C. Upon completion of installation, submit record documents. The documents shall be submitted for approval prior to final completion and include:
   1. Testing and Commissioning Reports and Checklists signed off by trained field commissioning personnel.
   2. Name, address and telephone number of Contractor personnel managing and installing equipment, along with service personnel responsible for supporting the ongoing warranty and services of the control system.
   3. Procedures for operating the BAS including logging on/off, alarm management, reading reports, trends, modification of setpoints, scheduling, and other interactive system requirements.
   4. Provide information on how to receive support from Pelican Wireless Systems and demonstrate that they are a direct supporting resource. Contact information for Technical Support from Pelican Wireless Systems is to be provided.

END OF SECTION 230922

SECTION 232300

REFRIGERANT PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.03 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.

2. Hot-Gas and Liquid Lines: 535 psig.

1.04 ACTION SUBMITTALS

A. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.05 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.06 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.07 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.01 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR.

B. Copper Tube: ASTM B 88, Type L.

C. Wrought-Copper Fittings: ASME B16.22.

D. Wrought-Copper Unions: ASME B16.22.

E. Brazing Filler Metals: AWS A5.8.

2.02 REFRIGERANTS

A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

A. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

3.02 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

J. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

K. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

L. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.

2. Install horizontal suction lines with a uniform slope downward to compressor.

3. Liquid lines may be installed level.

M. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

N. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

O. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."

P. Install sleeves for piping penetrations of walls, ceilings, and floors.

Q. Install sleeve seals for piping penetrations of concrete walls and slabs.

R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.03 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.

2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.04 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.

2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.

3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.

4. Spring hangers to support vertical runs.

5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.

2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.

3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.

4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.

5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.

6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.

7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.

9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.

3.05 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.

2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.

3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

   a. Fill system with nitrogen to the required test pressure.

   b. System shall maintain test pressure at the manifold gage throughout duration of test.

   c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.

   d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.06 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.

2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.

3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.

4. Charge system with a new filter-dryer core in charging line.

3.07 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Verify that compressor oil level is correct.

2. Open compressor suction and discharge valves.

3. Open refrigerant valves except bypass valves that are used for other purposes.

4. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

SECTION 233113

METAL DUCTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.

2. Single-wall round ducts and fittings.

3. Sheet metal materials.

4. Duct liner.

5. Sealants and gaskets.

6. Hangers and supports.

7. Seismic-restraint devices.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.

2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.03 PERFORMANCE REQUIREMENTS

A. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.

2. Sealants and gaskets.

3. Seismic-restraint devices.

B. LEED Submittals:

1. Product Data for Prerequisite IEQ 1: Documentation indicating that duct systems comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

2. Product Data for Prerequisite EA 2: Documentation indicating that duct systems comply with ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

3. Leakage Test Report for Prerequisite EA 2: Documentation of work performed for compliance with ASHRAE/IESNA 90.1, Section 6.4.4.2.2 - "Duct Leakage Tests."

4. Duct-Cleaning Test Report for Prerequisite IEQ 1: Documentation of work performed for compliance with ASHRAE 62.1, Section 7.2.4 - "Ventilation System Start-up."

5. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.

6. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.

2. Factory- and shop-fabricated ducts and fittings.

3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.

4. Elevation of top of ducts.

5. Dimensions of main duct runs from building grid lines.

6. Fittings.

7. Reinforcement and spacing.

8. Seam and joint construction.

9. Penetrations through fire-rated and other partitions.

10. Equipment installation based on equipment being used on Project.

11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.

12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.

2. Suspended ceiling components.

3. Structural members to which duct will be attached.

4. Size and location of initial access modules for acoustical tile.

5. Penetrations of smoke barriers and fire-rated construction.

6. Items penetrating finished ceiling including the following:

a. Lighting fixtures.

b. Air outlets and inlets.

c. Speakers.

d. Sprinklers.

e. Access panels.

f. Perimeter moldings.

B. Welding certificates.

C. Field quality-control reports.

1.06 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

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

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.

2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.01 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse

Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Lindab Inc.

b. McGill AirFlow LLC.

c. SEMCO Incorporated.

d. Sheet Metal Connectors, Inc.

e. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.

2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.04 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation; Insulation Group.

b. Johns Manville.

c. Knauf Insulation.

d. Owens Corning.

2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

   a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

   b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

3. Butt transverse joints without gaps, and coat joint with adhesive.

4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.

6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.

7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

   a. Fan discharges.

   b. Intervals of lined duct preceding unlined duct.

   c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

   a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.05 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

2. Tape Width: 4 inches.

3. Sealant: Modified styrene acrylic.

4. Water resistant.

5. Mold and mildew resistant.

6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.

7. Service: Indoor and outdoor.

8. Service Temperature: Minus 40 to plus 200 deg F.

9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.

2. Solids Content: Minimum 65 percent.

3. Shore A Hardness: Minimum 20.

4. Water resistant.

5. Mold and mildew resistant.

6. VOC: Maximum 75 g/L (less water).

7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.

8. Service: Indoor or outdoor.

9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.

2. Type: S.

3. Grade: NS.

4. Class: 25.

5. Use: O.

6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.

2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.

3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.06 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2.07 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.; a division of Cooper Industries.

2. Ductmate Industries, Inc.

3. Hilti Corp.

4. Mason Industries.

5. TOLCO; a brand of NIBCO INC.

6. Unistrut Corporation; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by the Office of Statewide Health Planning and Development for the State of California.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

D. Restraint Cables: ASTM A 603, galvanized-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod.

F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.01 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other

design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.02 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2. Outdoor, Supply-Air Ducts: Seal Class A.

3. Outdoor, Exhaust Ducts: Seal Class C.

4. Outdoor, Return-Air Ducts: Seal Class C.

5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.

6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.

7. Unconditioned Space, Exhaust Ducts: Seal Class C.

8. Unconditioned Space, Return-Air Ducts: Seal Class B.

9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.

10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.

11. Conditioned Space, Exhaust Ducts: Seal Class B.

12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.04 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.

2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.05 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems" and ASCE/SEI 7.

1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.

2. Brace a change of direction longer than 12 feet.

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by the Office of Statewide Health Planning and Development for the State of California.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Set anchors to manufacturer's recommended torque, using a torque wrench.

5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.06 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.07 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.08 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.

2. Test the following systems:

a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.

b. Supply, Return, Outdoor Air, Exhaust Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

4. Test for leaks before applying external insulation.

5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.

6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.

2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.09 DUCT CLEANING

A. Clean new and existing duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.

2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.

3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.

2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).

2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.

4. Coils and related components.

5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.

6. Supply-air ducts, dampers, actuators, and turning vanes.

7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.

2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.

4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.

5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

6. Provide drainage and cleanup for wash-down procedures.

7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.010 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.011 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated.

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units

a. Pressure Class: Positive 2-inch wg.

b. Minimum SMACNA Seal Class: C.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive 2-inch wg.

b. Minimum SMACNA Seal Class: C.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive 2-inch wg.

b. Minimum SMACNA Seal Class: C.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12.

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 2-inch wg.

b. Minimum SMACNA Seal Class: C.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 2-inch wg.

b. Minimum SMACNA Seal Class: C.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg.

b. Minimum SMACNA Seal Class: C.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
    a. Pressure Class: Negative 2-inch wg.
    b. Minimum SMACNA Seal Class: C.
    c. SMACNA Leakage Class for Rectangular: 24.
    d. SMACNA Leakage Class for Round and Flat Oval: 12
2. Ducts Connected to Air-Handling Units:
    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: C.
    c. SMACNA Leakage Class for Rectangular: 24.
    d. SMACNA Leakage Class for Round and Flat Oval: 12
3. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.
    a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
    b. Concealed: Type 304, stainless-steel sheet, No. 2D finish.
    c. Welded seams and joints.
    d. Pressure Class: Positive or negative 2-inch wg.
    e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
    f. SMACNA Leakage Class: 3.
4. Ducts Connected to Dishwasher Hoods:
    a. Type 304, stainless-steel sheet.
    b. Exposed to View: No. 4 finish.
    c. Concealed: No. 2D finish.
    d. Welded seams and flanged joints with watertight EPDM gaskets.
    e. Pressure Class: Positive or negative 2-inch wg.

f. SMACNA Leakage Class: 3.

5. Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air:

a. Type 316, stainless-steel sheet.

1) Exposed to View: No. 4 finish.

2) Concealed: No. 2D finish.

b. Pressure Class: Positive or negative 2-inch wg.

c. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.

d. SMACNA Leakage Class: 3.

6. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg.

b. Minimum SMACNA Seal Class: C.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 2-inch wg.

b. Minimum SMACNA Seal Class: C.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 2-inch wg.

b. Minimum SMACNA Seal Class: C.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg.

b. Minimum SMACNA Seal Class: C.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 12

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

G. Liner:

1. Supply and Return Air Ducts and Plenums: Fibrous glass, Type I, 1-1/2 inches thick.

2. Transfer Ducts: Fibrous glass, Type I, 2 inches thick.

H. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.

2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.

2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.

3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.

2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.

b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible,"

Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.

2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.

3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.

4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.

c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

I. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.

b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.

b. Velocity 1000 to 1500 fpm: Conical tap.

c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Barometric relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Fire dampers.
6. Ceiling radiation dampers.
7. Combination fire and smoke dampers.
8. Flange connectors.
9. Duct silencers.
10. Turning vanes.

11. Remote damper operators.

12. Duct-mounted access doors.

13. Flexible connectors.

14. Flexible ducts.

15. Duct accessory hardware.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. LEED Submittals:

1. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

2. Product Data for Prerequisite EA 2: Documentation indicating that duct insulation R-values comply with tables in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air Conditioning."

C. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.

b. Manual volume damper installations.

c. Control-damper installations.

d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.

e. Duct security bars.

f. Wiring Diagrams: For power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.02 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.

2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.03 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.

2. Pottorff.

3. Ruskin Company.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 2500 fpm.

D. Maximum System Pressure: 2-inch wg.

E. Frame: Hat-shaped, 18-gage galvanized sheet steel, with welded corners or mechanically attached and mounting flange.

F. Blades: Multiple single-piece blades, center pivoted, maximum 6-inch width, 0.025-inch-thick, roll-formed aluminum with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Extruded vinyl, mechanically locked.

I. Blade Axles:

1. Material: Plated steel.

2. Diameter: 0.20 inch.

J. Tie Bars and Brackets: Galvanized steel.

K. Return Spring: Adjustable tension.

L. Bearings: Synthetic pivot bushings.

M. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.

2. Counterweights and spring-assist kits for vertical airflow installations.

3. Chain pulls.

4. Screen Mounting: Front mounted in sleeve.

a. Sleeve Thickness: 20 gage minimum.

b. Sleeve Length: 6 inches minimum.

5. Screen Mounting: Rear mounted.

6. Screen Material: Galvanized steel.

7. Screen Type: Bird.

8. 90-degree stops.

2.04 BAROMETRIC RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.

2. Pottorff.

3. Ruskin Company.

B. Suitable for horizontal or vertical mounting.

C. Maximum Air Velocity: 2000 fpm.

D. Maximum System Pressure: 2-inch wg.

E. Frame: Hat-shaped, 16-gage, galvanized sheet steel with welded corners or mechanically attached and mounting flange.

F. Blades:

1. Multiple, 0.025-inch- thick, roll-formed alumrinum.

2. Maximum Width: 6 inches.

3. Action: Parallel.

4. Balance: Gravity.

5. Eccentrically pivoted.

G. Blade Seals: Vinyl.

H. Blade Axles: Plated steel.

I. Tie Bars and Brackets:

1. Material: Galvanized steel.

2. Rattle free with 90-degree stop.

J. Return Spring: Adjustable tension.

K. Bearings: Ball.

L. Accessories:

1. Flange on intake.

2. Adjustment device to permit setting for varying differential static pressures.

2.05 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Nailor Industries Inc.

b. Pottorff.

c. Ruskin Company.

d. Trox USA Inc.

2. Standard leakage rating.

3. Suitable for horizontal or vertical applications.

4. Frames:

a. Frame: Hat-shaped, 20-gage, galvanized sheet steel.

b. Mitered and welded corners.

c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

a. Multiple or single blade.

b. Parallel- or opposed-blade design.

c. Stiffen damper blades for stability.

d. Galvanized-steel, 0.064 inch thick.

6. Blade Axles: Plated steel.

7. Bearings:

a. Molded synthetic.

b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

2.06 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.

2. Pottorff.

3. Ruskin Company.

4. Young Regulator Company.

B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:

1. Hat shaped.

2. 16-gage, galvanized sheet steel.

3. Reinforced corners.

D. Blades:

1. Multiple blade with maximum blade width of 6 inches.

2. Opposed-blade design.

3. Aluminum.

4. 0.063 inch thick single skin.

5. Blade Edging: TPE.

E. Blade Axles: 1/2-inch- diameter; plated steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

F. Bearings:

1. Molded synthetic.

2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

3. Thrust bearings at each end of every blade.

2.07 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.

2. Pottorff.

3. Ruskin Company.

B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Curtain type with blades outside airstream, fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory-installed, galvanized sheet steel.

1. Minimum Thickness: 0.138 inch thick, and of length to suit application.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.034-inch-thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.08 CEILING RADIATION DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.

2. Pottorff.

3. Ruskin Company.

B. General Requirements:

1. Labeled according to UL 555C by an NRTL.

2. Comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."

C. Frame: Galvanized sheet steel, round or rectangular, style to suit ceiling construction.

D. Blades: Galvanized sheet steel with refractory insulation.

E. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

F. Fire Rating: 1 hour.

2.09 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.

2. Pottorff.

3. Ruskin Company.

B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel, with welded or mechanically attached corners and mounting flange.

F. Heat-Responsive Device: Electric resettable device and switch package, factory installed, rated.

G. Smoke Detector: Integral, factory wired for single-point connection.

H. Blades: Roll-formed, horizontal, interlocking, 16-gage, galvanized sheet steel.

I. Leakage: Class II.

J. Rated pressure and velocity to exceed design airflow conditions.

K. Mounting Sleeve: Factory-installed, 0.039-inch-thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

L. Master control panel for use in dynamic smoke-management systems.

M. Damper Motors: Two-position action.

N. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230900 "Instrumentation and Control for HVAC."

3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.

4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.

5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.

6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.

7. Electrical Connection: 115 V, single phase, 60 Hz.

O. Accessories:

1. Test and reset switches, remote mounted.

2.010 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.

2. Nexus PDQ; Division of Shilco Holdings Inc.

3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.011 DUCT SILENCERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dynasonics.

2. Industrial Noise Control, Inc.

3. McGill AirFlow LLC.

4. Ruskin Company.

5. Vibro-Acoustics.

B. General Requirements:

1. Factory fabricated.

2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.

3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Shape:

1. Rectangular straight with splitters or baffles.

2. Round straight with center bodies or pods.

3. Rectangular elbow with splitters or baffles.

4. Round elbow with center bodies or pods.

5. Rectangular transitional with splitters or baffles.

D. Rectangular Silencer Outer Casing: ASTM A 653/A 653M, G90, galvanized sheet steel, 0.040 inch thick.

E. Round Silencer Outer Casing: ASTM A 653/A 653M, G90, galvanized sheet steel.

1. Sheet Metal Thickness for Units up to 24 Inches in Diameter: 0.034 inch thick.

2. Sheet Metal Thickness for Units 26 through 40 Inches in Diameter: 0.040 inch thick.

3. Sheet Metal Thickness for Units 42 through 52 Inches in Diameter: 0.05 inch thick.

4. Sheet Metal Thickness for Units 54 through 60 Inches in Diameter: 0.064 inch thick.

F. Inner Casing and Baffles: ASTM A 653/A 653M, G90 galvanized sheet metal, 0.034 inch thick, and with 1/8-inch- diameter perforations.

G. Special Construction:

1. Suitable for outdoor use.

2. High transmission loss.

H. Connection Sizes: Match connecting ductwork unless otherwise indicated.

I. Principal Sound-Absorbing Mechanism:

1. Controlled impedance membranes and broadly tuned resonators without absorptive media.

2. Film-lined type with fill material.

a. Fill Material: Inert and vermin-proof fibrous material, packed under not less than 15 percent compression.

b. Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.

3. Lining: Mylar.

J. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.

1. Joints: Lock formed and sealed.

2. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.

3. Reinforcement: Cross or trapeze angles for rigid suspension.

K. Accessories:

1. Factory-installed end caps to prevent contamination during shipping.

2. Removable splitters.

L. Source Quality Control: Test according to ASTM E 477.

1. Record acoustic ratings, including dynamic insertion loss and generated-noise power levels with an airflow of at least 2000-fpm face velocity.

2. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg static pressure, whichever is greater.

2.012 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.

2. Duro Dyne Inc.

3. METALAIRE, Inc.

4. SEMCO Incorporated.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

E. Vane Construction: Double wall.

2.013 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pottorff.

2. Ventfabrics, Inc.

3. Young Regulator Company.

B. Description: Cable system designed for remote manual damper adjustment.

C. Tubing: Galvanized spiral wire sheath.

D. Cable: Stainless steel.

E. Wall-Box Mounting: Recessed.

F. Wall-Box Cover-Plate Material: Steel.

2.014 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.

2. Greenheck Fan Corporation.

3. Pottorff.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.

b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.

c. Vision panel.

d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.

e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.

b. Access Doors up to 18 Inches Square: Continuous and two sash locks.

c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.

d. Access Doors Larger Than 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.

C. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.

2. Door: Single wall or double wall with insulation fill with metal thickness applicable for duct pressure class.

3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.

4. Factory set.

5. Doors close when pressures are within set-point range.

6. Hinge: Continuous piano.

7. Latches: Cam.

8. Seal: Neoprene or foam rubber.

9. Insulation Fill: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.015 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.

2. Flame Gard, Inc.

3. 3M.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 11-gage carbon steel.

D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.016 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.

2. Duro Dyne Inc.

3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..

2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.

3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..

2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.

3. Service Temperature: Minus 50 to plus 250 deg F.

G. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.

1. Minimum Weight: 16 oz./sq. yd..

2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.

3. Service Temperature: Minus 67 to plus 500 deg F.

H. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.

1. Minimum Weight: 14 oz./sq. yd..

2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.

3. Service Temperature: Minus 67 to plus 500 deg F.

I. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.

2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.

7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.017 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexmaster U.S.A., Inc.

2. McGill AirFlow LLC.

3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, polyethylene film supported by helically wound, galvanized-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.

2. Maximum Air Velocity: 5500 fpm.

3. Temperature Range: Minus 10 to plus 160 deg F.

4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

C. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

2.018 DUCT SECURITY BARS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carnes.

2. KEES, Inc.

3. Lloyd Industries, Inc.

4. Metal Form Manufacturing, Inc.

5. Price Industries.

B. Description: Factory-fabricated and field-installed duct security bars.

C. Configuration:

1. Frame: 2-1/2 by 2-1/2 by 1/4 inch angle.

2. Sleeve: 0.1345-inch, continuously welded steel frames with 1-by-1-by-3/16-inch angle frame factory welded to 1 end. To be poured in place or set with concrete block or welded or bolted to wall, one side only. Duct connections on both sides.

3. Horizontal Bars: 1/2 inch.

4. Vertical Bars: 1/2 inch.

5. Bar Spacing: 6 inches.

6. Mounting: Bolted or welded.

D. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

E. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.

2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Connect ducts to duct silencers rigidly.

I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.

2. Upstream from duct filters.

3. At outdoor-air intakes and mixed-air plenums.

4. At drain pans and seals.

5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.

6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.

7. At each change in direction and at maximum 50-foot spacing.

8. Upstream from turning vanes.

9. Upstream or downstream from duct silencers.

10. Control devices requiring inspection.

11. Elsewhere as indicated.

J. Install access doors with swing against duct static pressure.

K. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.

2. Two-Hand Access: 12 by 6 inches.

3. Head and Hand Access: 18 by 10 inches.

4. Head and Shoulders Access: 21 by 14 inches.

5. Body Access: 25 by 14 inches.

6. Body plus Ladder Access: 25 by 17 inches.

L. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

M. Install flexible connectors to connect ducts to equipment.

N. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

O. Connect diffusers to ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.

P. Connect flexible ducts to metal ducts with draw bands.

Q. Install duct test holes where required for testing and balancing purposes.

R. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.02 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.

2. Inspect locations of access doors and verify that purpose of access door can be performed.

3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.

4. Inspect turning vanes for proper and secure installation.

5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233423

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Utility set fans.

2. Centrifugal roof ventilators.

3. Ceiling-mounted ventilators.

4. In-line centrifugal fans.

1.03 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on actual project site elevations.

B. Operating Limits: Classify according to AMCA 99.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:

1. Certified fan performance curves with system operating conditions indicated.

2. Certified fan sound-power ratings.

3. Motor ratings and electrical characteristics, plus motor and electrical accessories.

4. Material thickness and finishes, including color charts.

5. Dampers, including housings, linkages, and operators.

6. Roof curbs.

7. Fan speed controllers.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Wiring Diagrams: For power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Roof framing and support members relative to duct penetrations.

2. Ceiling suspension assembly members.

3. Size and location of initial access modules for acoustical tile.

4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

B. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set for each belt-driven unit.

1.08 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.09 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.01 UTILITY SET FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.

2. Loren Cook Company.

3. Aerovent; a division of Twin City Fan Companies, Ltd.

B. Housing: Fabricated of galvanized steel with side sheets fastened with a deep lock seam or welded to scroll sheets.

1. Housing Discharge Arrangement: Adjustable to eight standard positions.

C. Fan Wheels: Single-width, single inlet; welded to cast-iron or cast-steel hub and spun-steel inlet cone, with hub keyed to shaft.

1. Blade Materials: Steel.

2. Blade Type: Backward inclined.

D. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.

E. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings with ABMA 9, L_{50} of 200,000 hours.

1. Extend grease fitting to accessible location outside of unit.

F. Belt Drives:

1. Factory mounted, with final alignment and belt adjustment made after installation

2. Service Factor Based on Fan Motor Size: 1.5.

3. Motor Pulleys: Adjustable pitch for use with motors through **5** hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.

4. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.

5. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.

G. Accessories:

1. Inlet and Outlet: Flanged.

2. Companion Flanges: Rolled flanges for duct connections of same material as housing.

3. Backdraft Dampers: Gravity actuated with counterweight and interlocking aluminum blades with felt edges in steel frame installed on fan discharge.

4. Access Door: Gasketed door in scroll with latch-type handles.

5. Inlet Screens: Removable wire mesh.

6. Drain Connections: NPS 3/4 threaded coupling drain connection installed at lowest point of housing.

7. Weather Hoods: Weather resistant with stamped vents over motor and drive compartment.

2.02 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.

2. Loren Cook Company.

3. Aerovent; a division of Twin City Fan Companies, Ltd.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Belt Drives:

1. Resiliently mounted to housing.

2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.

3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.

4. Pulleys: Cast-iron, adjustable-pitch motor pulley.

5. Fan and motor isolated from exhaust airstream.

E. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.

3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.

4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

5. .

F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Built-in cant and mounting flange.

2. Overall Height: As required to maintain 12” above finish roof.

3. Sound Curb: Curb with sound-absorbing insulation.

4. Pitch Mounting: Manufacture curb for roof slope.

5. Metal Liner: Galvanized steel.

2.03 CEILING-MOUNTED VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.

2. Loren Cook Company.

3. Aerovent; a division of Twin City Fan Companies, Ltd.

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Plastic or painted aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.

3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.

4. Motion Sensor: Motion detector with adjustable shutoff timer.

5. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link.

6. Filter: Washable aluminum to fit between fan and grille.

7. Isolation: Rubber-in-shear vibration isolators.

8. Manufacturer's standard roof jack or wall cap, and transition fittings.

2.04 IN-LINE CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.

2. Loren Cook Company.

3. Aerovent; a division of Twin City Fan Companies, Ltd.

B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.

D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.

3. Companion Flanges: For inlet and outlet duct connections.

4. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.

5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

6. Vibration Isolators:

a. Type: Spring hangers.

b. Static Deflection: 1 inch.

2.05 MOTORS

A. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Enclosure Type: Totally enclosed, fan cooled.

2.06 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install power ventilators level and plumb.

B. Equipment Mounting:

1. Install power ventilators on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in other sections.

2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

C. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Section 077200 "Roof Accessories" for installation of roof curbs.

D. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

E. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Section 230548 "Vibration and Seismic Controls for HVAC."

F. Install units with clearances for service and maintenance.

G. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.02 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.03 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.

2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.

3. Verify that cleaning and adjusting are complete.

4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.

5. Adjust belt tension.

6. Adjust damper linkages for proper damper operation.

7. Verify lubrication for bearings and other moving parts.

8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.

10. Shut unit down and reconnect automatic temperature-control operators.

11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.04 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION 233423

SECTION 23 37 13

AIR DIFFUSERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Round ceiling diffusers.

2. Modular core, square ceiling diffusers.

3. Perforated diffusers.

4. Linear bar diffusers.

5. Linear slot diffusers.

6. Drum Louvers

B. Related Sections:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.

2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members.

2. Method of attaching hangers to building structure.

3. Size and location of initial access modules for acoustical tile.

4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

5. Duct access panels.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.01 CEILING DIFFUSERS

A. Round Ceiling Diffuser:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Price Industries.

   b. Titus.

   c. Anemostat Products; a Mestek company.

2. Devices shall be specifically designed for variable-air-volume flows.

3. Material: Steel.

4. Finish: Baked enamel, color selected by Architect.

5. Face Style: Three cone.

6. Mounting: Duct connection.

7. Pattern: Two-position horizontal.

B. Modular Core, Square Ceiling Diffuser:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Price Industries.

   b. Titus.

   c. Anemostat Products; a Mestek company.

2. Devices shall be specifically designed for variable-air-volume flows.

3. Material: Steel.

4. Finish: Baked enamel, color selected by Architect.

5. Face Style: Modular Core.

6. Mounting: Surface.

7. Pattern: Adjustable.

C. Perforated Diffuser:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Price Industries.

b. Titus.

c. Anemostat Products; a Mestek company.

2. Devices shall be specifically designed for variable-air-volume flows.

3. Material: Steel.

4. Finish: Baked enamel, color selected by Architect.

5. Duct Inlet: Square.

6. Face Style: Flush.

7. Mounting: T-bar.

8. Pattern Controller: Adjustable with louvered pattern modules at inlet.

2.02 CEILING LINEAR SLOT OUTLETS

A. Linear Bar Diffuser:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Price Industries.

   b. Titus.

   c. Anemostat Products; a Mestek company.

2. Devices shall be specifically designed for variable-air-volume flows.

3. Material: Steel.

4. Finish: Baked enamel, color selected by Architect.

5. Narrow Core Spacing Arrangement: 1/8-inch-thick blades spaced 1/4 inch apart, zero-degree deflection.

6. One-Way Deflection Vanes: Extruded construction fixed louvers with removable core.

7. Mounting: Concealed bracket.

8. Accessories: Blank-off strips.

B. Linear Slot Diffuser:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Price Industries.

b. Titus.

c. Anemostat Products; a Mestek company.

2. Devices shall be specifically designed for variable-air-volume flows.

3. Material - Shell: Aluminum.

4. Material - Pattern Controller: Steel.

5. Finish: Baked enamel, color selected by Architect.

6. Slot Width: As indicated on plans.

7. Number of Slots: As indicated on plans.

8. Length: As indicated on plans.

2.03 REGISTERS AND GRILLES

A. Adjustable Bar Grille:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Price Industries.

b. Titus.

c. Anemostat Products; a Mestek company.

2. Material: Steel.

3. Finish: Baked enamel, color selected by Architect.

4. Face Blade Arrangement: Horizontal spaced 3/4 inch apart.

5. Core Construction: Integral.

6. Rear-Blade Arrangement: Vertical spaced 3/4 inch apart.

7. Mounting: Concealed.

2.04 HIGH-CAPACITY DIFFUSERS

A. Drum Louver:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Price Industries.

b. Titus.

c. Anemostat Products; a Mestek company.

2. Airflow Principle: Extended distance for high airflow rates.

3. Material: Aluminum, heavy gage extruded.

4. Finish: Confirm with Architect.

5. Border: 1-1/4-inch (32-mm) width with countersunk screw holes.

6. Gasket between drum and border.

7. Body: Drum shaped; adjustable vertically.

8. Blades: Individually adjustable horizontally.

9. Mounting: Surface to wall.

10. Accessories:

    a. Duct-mounting collars with countersunk screw holes.

2.05 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.03 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 238126

SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. LEED Submittals:

1. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Wiring Diagrams: For power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set for each air-handling unit.

2. Gaskets: One set for each access door.

3. Fan Belts: One set for each air-handling unit fan.

1.07 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."

2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.08 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.

b. For Parts: One year from date of Substantial Completion.

c. For Labor: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier Corporation; Home Comfort and HVAC Building & Industrial Systems.

2. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division.

3. Trane; a business of American Standard companies.

4. YORK; a Johnson Controls company.

2.02 INDOOR UNITS (5 TONS OR LESS)

A. Concealed Evaporator-Fan Components:

1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.

2. Insulation: Faced, glass-fiber duct liner.

3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.

4. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.

5. Fan Motors:

a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

b. Multitapped, multispeed with internal thermal protection and permanent lubrication.

c. Wiring Terminations: Connect motor to chassis wiring with plug connection.

6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

7. Filters: Permanent, cleanable.

8. Condensate Drain Pans:

   a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

      1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.

      2) Depth: A minimum of 2 inches deep.

   b. Single-wall, galvanized-steel sheet.

   c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

      1) Minimum Connection Size: NPS 1.

   d. Pan-Top Surface Coating: Asphaltic waterproofing compound.

   e. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

B. Wall-Mounted, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.

2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.

3. Fan: Direct drive, centrifugal.

4. Fan Motors:

   a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

   b. Multitapped, multispeed with internal thermal protection and permanent lubrication.

   c. Enclosure Type: Totally enclosed, fan cooled.

   d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.

   e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

   f. Mount unit-mounted disconnect switches on exterior of unit.

5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

6. Filters: Permanent, cleanable.

7. Condensate Drain Pans:

   a. Fabricated with **one** percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.

2) Depth: A minimum of 1 inch deep.

b. Single-wall, galvanized-steel sheet.

c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

1) Minimum Connection Size: NPS 1.

d. Pan-Top Surface Coating: Asphaltic waterproofing compound.

2.03 INDOOR UNITS (6 TONS OR MORE)

A. Concealed Evaporator-Fan Components:

1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.

2. Insulation: Faced, glass-fiber duct liner.

3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.

4. Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch; leak tested to 300 psig underwater; with a two-position control valve.

5. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.

6. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.

7. Fan Motors:

a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

b. Multitapped, multispeed with internal thermal protection and permanent lubrication.

c. Three-phase, permanently lubricated, ball-bearing motors with built-in thermal-overload protection.

d. Wiring Terminations: Connect motor to chassis wiring with plug connection.

8. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

9. Filters: 1 inch thick, in fiberboard frames.

10. Condensate Drain Pans:

a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.

2) Depth: A minimum of 2 inches deep.

b. Single-wall, galvanized-steel sheet.

c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

1) Minimum Connection Size: NPS 1.

d. Pan-Top Surface Coating: Asphaltic waterproofing compound.

e. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

2.04 OUTDOOR UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

a. Compressor Type: Scroll.

b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.

c. Refrigerant Charge: R-410A.

d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.

3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.

4. Fan: Aluminum-propeller type, directly connected to motor.

5. Motor: Permanently lubricated, with integral thermal-overload protection.

6. Low Ambient Kit: Permits operation down to 45 deg F.

7. Mounting Base: Polyethylene.

2.05 OUTDOOR UNITS (6 TONS OR MORE)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

a. Compressor Type: Scroll.

b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.

c. Refrigerant Charge: R-410A.

d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.

3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.

4. Fan: Aluminum-propeller type, directly connected to motor.

5. Motor: Permanently lubricated, with integral thermal-overload protection.

6. Low Ambient Kit: Permits operation down to 45 deg F.

7. Mounting Base: Polyethylene.

2.06 ACCESSORIES

A. Control equipment and sequence of operation are specified in Section 230900 "Instrumentation and Control for HVAC" and Section 230993 "Sequence and Operations for HVAC Controls."

B. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:

1. Compressor time delay.

2. 24-hour time control of system stop and start.

3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.

4. Fan-speed selection including auto setting.

C. Automatic-reset timer to prevent rapid cycling of compressor.

D. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

E. Drain Hose: For condensate.

F. Additional Monitoring:

1. Monitor constant and variable motor loads.

2. Monitor variable-frequency-drive operation.

3. Monitor economizer cycle.

4. Monitor cooling load.

5. Monitor air distribution static pressure and ventilation air volumes.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

D. Equipment Mounting:

1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in other sections.

2. Install ground-mounted, compressor-condenser components on polyethylene mounting base.

3. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

4. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

E. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.02 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.04 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general administrative and procedural requirements for Division 26/27/28 that supplements the requirements specified in Division 01.

B. This section supplements all Sections of this Division and shall apply to all phases of Work specified, indicated in the Contract Documents, and as required to provide for a complete installation of electrical systems for the Project. Review all sections of the Specifications and drawings for related work and coordinate the work of this Section with all other Sections.

C. Should there be any direct conflict in the specifications and drawings the most stringent requirement shall govern.

D. The scope of work shall include but not be limited to the following:

1. Perform all incidental work required to provide a complete properly operating system. Provide the type and quantity of electrical materials and equipment necessary to complete Work and all systems in operation, tested and ready for use.
2. Provide all incidental items that belong to the Work described and which are required for complete systems.
3. Provide construction power and lighting.
4. Provide power for testing of equipment and systems through final acceptance tests.
5. Provide Electric power primary and secondary conduits and cables, low voltage (600 volts and below) cables and communication conduits and cables for data/telephone/CATV, underground utility structures including vaults (power & communications) and pull boxes from their respective locations where service for the designated system are provided. Where conduits or ducts are stubbed out and capped for future extension, concrete markers with utility pull boxes (17’x30” minimum) shall be provided at the finished grade to indicate the ends of the stubs.
6. Provide outlet, junction and pull boxes, plaster rings, plates, pull lines, and conduit for communication systems.
7. Provide and coordinate the installation of the following items per applicable codes and manufacturer’s recommended performance criteria:
    a. Support and seismic restraint for all suspended or floor mounted equipment, raceways, etc.
    b. Vibration isolators and seismic anchorage for all floor mounted equipment.
8. Provide testing described in individual sections and Section 26 96 00.D

9. Provide assistance to district's team in collection of data for Pre-Functional and Functional tests.

E. Related work: Consult all other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable installation.

1. General and supplementary conditions: Drawings and general provisions of Contract and Division 01 of the Specifications, apply to all Division 26/27/28 Sections.
2. Earthwork: Include trenching, backfilling, boring and soil compaction as required for the installation of underground conduit, in-grade pull boxes, vaults etc.
3. Concrete work: Include forming, steel bar reinforcing, cast-in- place concrete, finishing and grouting as required for underground conduit encasement, pull box slabs, vaults, housekeeping pads, etc.
4. Moisture protection and smoke barrier penetrations: Include membrane clamps, sheet metal flashing, counter flashing, caulking and sealant as required for waterproofing of conduit penetrations and sealing penetrations in or through fire walls, floors, ceiling slabs and foundation walls. All penetrations through vapor barriers at slabs on grade shall be taped and made vapor-tight.
5. Firestopping: Include firestopping and through-penetration protection system materials and accessories; firestopping tops of fire rated walls; and smoke sealing at joints between floor slabs and exterior walls.
6. Access panels and doors: fire rated as required, in the ceilings, walls and walls where necessary for access to electrical equipment, devices, junction boxes, pull boxes, conduit stubs, etc., located in the walls, floors or furred and T-Bar ceiling spaces. All access panel locations shall be coordinated with Architect.
7. Painting: Include surface preparation, priming and finish coating as required for electrical cabinets, exposed conduit, pull and junction boxes, etc. where indicated as field painted in this Division.
8. Miscellaneous metal work: Include fittings, brackets, backing, supports, rods, welding and pipe as required for support and bracing of raceways, lighting fixtures, panel boards, distribution boards, motor control centers, switchboards, switchgear, transformers, etc.
9. General installation: Provide all sleeves, hangers, supports, inserts, anchors, bolts, etc., required for the installation of this work.

F. Construction Documents Drawings and Data

1. The drawings show the general arrangement of all piping, ductwork, conduit and equipment. Examine drawings and specifications very carefully and notify the District's Representative of any discrepancies so these can be rectified at an early date.
2. Should conditions necessitate any rearrangements, the Contractor shall prepare and submit drawings showing the changes before proceeding with the work. If such changes are approved, they shall become a part of this contract after their approval.
3. The drawings are diagrammatic and are a graphic representation of the Contract Requirements, produced according to the best available standards to an optimum scale. Dimensions of work as indicated on plans are not to be used as as-built dimensions. No measurements shall be scaled from the Drawings for use as a definite dimension for layout or fitting equipment and devices in place. The dimensions of all equipment and devices shall be based on the approved shop drawing submittals used on the project. The Contractor is solely responsible for dimensional control and coordination of the work to be installed.
4. The layout of equipment, as shown on the plans, shall be verified and exact location determined by dimensions of equipment accepted for installation. Consult the Architectural, Structural drawings and other contract documents for all dimensions, locations of partitions, sizes of structural members, foundations, etc.

5. The Contractor shall be responsible for the coordination of the electrical installation with ducts, pipes, fire sprinklers, raceways, cable trays, structural members, ceiling support and all other systems and other applicable trades within the project.

G. Minor Deviations from Construction Documents

1. Where the equipment furnished requires redesign of layouts, connections, or configuration, and such deviations are acceptable to the District's Representative and Architect, the contractor shall provide dimensioned engineered layouts for review and approval.
2. Certified Reports and Calculations: Where the equipment size, dimensions and weight are different than indicated on drawings, submit certified report including seismic calculations for anchorage or support to the Engineer of Record for review/approval prior to submitting to the AHJ.

   a. Submit structural calculations and shop drawings for electrical equipment support.
   b. Submit anchorage calculations for floor and wall mounted electrical equipment so that it shall remain secured and attached to the mounting surface after experiencing forces in conformance with all the requirements stated in the local and state Building Codes. Specify proof loads for drilled-in anchors, if used.
   c. Submit detailed information regarding the forces exerted by the restraints, anchorages, and other points of attachment to structure.
   d. All Calculations shall be prepared, stamped and signed by a professional Structural Engineer registered in the state.

1.2 REFERENCES

A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Such codes or standards shall be considered a part of this Specification as though fully repeated herein.

B. When codes, standards, regulations, etc. allow work of lesser quality or extent than is specified under this Division, nothing in said codes shall be construed or inferred authority for reducing the quality, requirements or extent of the Drawings and Specifications. The contract documents address the minimum requirements for construction.

C. Before bidding, be familiar with rulings of the building and inspection departments and comply with such requirement. Rulings and interpretations of authorities shall be considered as part of the regulations.

D. It is not the intent of Drawings and Specifications to repeat requirements of codes except where necessary for completeness or clarity. Nothing in the Drawings or Specifications is to be construed to permit work not conforming to the applicable codes and regulations adopted by the Division of State Architect. Should there be any direct conflict between Contract Documents and applicable codes and regulations the codes and regulations shall govern.

E. Work shall be performed in accordance with all applicable requirements of the listed edition of all governing 2019 California codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not:

F. Standards: Equipment and materials specified under this Division shall conform to the following standards where applicable:

1. ACI - American Concrete Institute.
2. AEIC - Association of Edison Illuminating Companies
3. AISI - American Iron and Steel Institute
4. ANSI - American National Standards Institute
5. ASTM - American Society for Testing Materials
6. CBM - Certified Ballast Manufacturers

7. ETL - Electrical Testing Laboratories
8. FAA - Federal Aviation Administration
9. FCC - Federal Communications Commission
10. FM - Factory Mutual
11. FS - Federal Specification
12. ICEA - Insulated Cable Engineers Association
13. IEEE - Institute of Electrical and Electronics Engineers, Inc
14. IESNA - Illuminating Engineering Society of North America
15. ISO - International Standardization Organization
16. NEMA - National Electrical Manufacturer's Association
17. NETA - National Electrical Testing Association
18. NFPA - National Fire Protection Association
19. OSHA - Occupational Safety and Health Act
20. UL - Underwriters Laboratories

1.3 SUBMITTALS

A. Submittals for each section shall conform to the general guidelines and procedures of Division 01 and this section.

B. Submittal Schedule:

1. Provide a submittal schedule in accordance with Division 01 requirements.
2. The submittal schedule shall be a complete list of all submittals to be made with projected dates of all submittals.
3. The submittal schedule shall assume at least one “Revise and Resubmit” cycle. Delays to schedule associated with submittals’ “Revise and Resubmit” designation are ineligible for change orders, as timely and correct work is a requirement of this contract.

C. General Organization of Submittals:

1. Submittals shall be neatly bound in an 8-1/2" x 11" folder or binder for each Specification Section with a table of contents listing materials by Section and paragraph number.
2. Submittals shall consist of detailed shop drawings, specifications, block wiring diagrams, "catalog cuts" and data sheets containing physical and dimensional information, performance data, electrical characteristics, materials used in fabrication, and material finish. Clearly indicate by arrows or brackets precisely what is being submitted on and those optional accessories which are included and those which are excluded.
3. Organize submittals in the same sequence as they appear in specification sections, articles or paragraphs.
4. Each submission shall be made under the Specification Section Number it has been specified under. Submittals including equipment specified under a different specification section will be rejected and returned without review. Each section is required to be tracked separately for status designation, even if multiple sections are physically collated into a single binder.
5. Identify each item with each submittal by reference to Specification Section paragraph in which the item is specified or Drawing and Detail number. Annotate the submittal sheets with the equipment identification numbers appearing on the equipment schedule.
6. Include all information requested by the Specification Section in a single submittal. With the exception of shop drawings, incomplete submittals or phased submittals under the same specification section are not acceptable and will be returned without review.
7. Submit pertinent catalog and performance data sheets only. Annotate pages to clearly identify which specific product is submitted and for what tag number or application. Contractors shall not submit entire catalogs.
8. Submission shall be made in the form of a tab-indexed brochure. Index sheets shall be required for all material and equipment.

9. Each submittal shall be accompanied by a cover letter or shall bear a stamp stating that the submittal has been thoroughly reviewed by the Contractor and is in full compliance with the requirements of the Contract Documents. Cover letters shall list in full the items and data submitted. Failure to comply with this requirement shall constitute grounds for rejection of data.

D. Equipment Submittals:

1. Identify each item by manufacturer, brand, trade name, number, size, rating, or whatever other data is necessary to properly identify and check materials and equipment. Words "as specified" are not sufficient identification.
2. Mark the exact equipment item and data on each sheet. Where multiple product model types are listed on a single sheet, the contractor shall clearly indicate which specific items are submitted. If different model numbers of a single product line are submitted for different uses, this should be clearly annotated, identifying each individual use cross-referenced by the requirement it intends to fulfill. Submittals without annotation will be rejected and returned without review.
3. Submittal literature, drawings and wiring diagrams shall be specifically applicable to this project and shall not contain extraneous material or optional choices. Clearly mark literature to indicate the proposed item and its relevant features or options. Submittals shall include all those items listed in each individual Section.
4. As part of the equipment submittals, the manufacturer shall submit documentation to indicate that the entire assembly is suitable and certified to meet all applicable seismic requirements. In addition, the manufacturer shall recommend the method of anchoring the equipment to the mounting surface, including the assembly dimensions, weights and approximate centers of gravity.

E. Shop Drawings:

1. Provide shop drawings for all systems as required per individual Division 01 & 26 specification sections, drawings or Construction Documents.
2. All equipment shall be shown to scale and shall match the required dimensions from the equipment submittals. All equipment access clearances shall be marked explicitly on the Shop Drawings with manufacturer and code required distances dimensioned and annotated as such.
3. The drawings shall be minimum 1/4" = 1'-0" scale.
4. Independent structural support and structural pad drawings shall be submitted for review by Structural Engineer.
5. All equipment shall be labeled to match the drawings.
6. The Contractor shall assure that each trade has coordinated work with other trades, prior to submittal. Division 26 shop drawings shall be issued after the coordination drawings are signed off by all other trades. Any conflicts that occur with other trades shall be brought to the attention of the District's Representative prior to issuance of the shop drawings.
7. Provide detailed drawings of all electrical equipment rooms, yards and utility areas. Revised electrical equipment layouts must be reviewed and approved prior to release of order for equipment and prior to installation.

F. Substitutions:

1. All requests for substitutions shall conform to the general requirements and procedure outlined in Division 01.
2. Where items are noted as "or equal," a product of equal design, construction and performance will be considered. Contractor must submit all pertinent test data, catalog cuts and product information required substantiating that the product is in fact equal to that specified. Only one substitution will be considered for each product specified.
3. Manufacturers' names and model numbers used in conjunction with materials, processes or equipment included in the Contract Documents are used to establish standards of quali

ty, utility and appearance. Materials, processes or equipment, which, in the opinion of the District's Representative, is equal in quality, utility and appearance, will be approved as substitutions to that specified.

4. Whenever any material, process or equipment is specified in accordance with a Federal specification, ASTM standard, ANSI specification, UL listing or other association standard, the Contractor shall present an affidavit from the manufacturer certifying that the product complies with the particular standard specification. When requested by the District's Representative, support test data to substantiate compliance shall be submitted by the Contractor at no additional cost.
5. Substitutions shall be equal, in the opinion of the District's Representative, where **noted as district standards no substitutions are permitted to the specified product.** The burden of proof of such shall rest with the Contractor. When the District's Representative, in writing, accepts a substitution, it is with the understanding that the Contractor guaranteed the substituted article or material to be equal to the one specified and dimensioned to fit within the construction. Approved substitutions shall not relieve the Contractor of responsibilities for the proper execution of the work, or from any provisions of the Specifications.
6. The Contractor shall be responsible for all expenses in connection with the substitution materials, processes and equipment, including the effect of his substitution on him, his subcontractor's or other Contractor's work. No substitution of material, processes or equipment shall be permitted without written authorization of the District's Representative. Any assumptions on the acceptability of a proposed substitution prior to acceptance by the District's Representative are at the sole risk of the Contractor.

G. Resubmittals:

1. All re-submittals shall include a cover letter that lists the action taken and revisions made to every drawing and equipment data sheet in response to Submittal Review Comments. Re-submittal packages will not be reviewed unless accompanied by this cover letter. Failure to include this cover letter will constitute rejection of the re-submittal package.
2. Resubmittals shall be complete and shall be explicitly annotated to note all changes. Contractor shall not just include specific responses to review comments but shall show how the resubmittal data has been corrected and how all consequences of the change have been accommodated.
3. Changes made in the resubmittal which are not directly a response to an earlier review comment shall be clearly identified on the letter of transmittal provided with the re-submittal and annotated within the body of the submittal. The reason for the change shall be included.
4. Non-compliant items which were not noticed in an earlier submittal but are noticed in a resubmittal shall be noted as non-compliant and the resubmittal tagged for corrective action. The fact that the District's Representative may have overlooked the defect shall not constitute total or partial acceptance of it. The contractor remains responsible for delivering an installation that meets the design intent. All corrective action shall be performed at no additional cost or delay to the project.

1.4 QUALITY ASSURANCE

A. Nothing in these plans or specifications is to be construed to permit work not conforming to the prevailing codes and regulations. Should there be any direct conflict between any referenced standard and the governing code, the mandatory code language shall govern to set only the minimum requirements and the most stringent requirement shall govern.

B. Factory and Field Testing

1. See each Section for the required testing and procedures.
2. Test reports shall include:

   a. Description of equipment tested

b. Description of test procedures
c. Test results
d. Names and signatures of witnesses of tests.

3. Notify the District's Representative 14 days in advance of when tests will be performed.

C. Electrical Acceptance Testing

1. Contractor shall engage the services of a qualified third party testing agency for the purpose of performing inspections and tests of installed Work as herein specified and specified in other Sections of Division 26 of these Specifications.
2. The testing agency shall provide all material, equipment, labor and technical supervision to perform such tests and inspections.
3. All tests shall be performed in compliance with the recommendations and requirements of the NETA and applicable codes and standards.
4. Upon completion of the tests and inspections noted in these specifications, a label shall be attached to all tested devices and equipment. These labels shall indicate date tested and the testing company responsible.
5. The tests and inspections shall determine suitability for continued reliable operation.
6. All tests shall be conducted in the presence of District's Representative and Inspector of Record (IOR).
7. Test reports: All test forms, results and reports shall be typed in their final form.

D. Materials and Standards

1. The label of listing by UL shall appear on all materials and equipment for which standards have been established by the agency.
2. Where codes listed in Division 01, establish label or approval requirements, furnish all materials and equipment with either the required labels affixed or the necessary written approval.
3. All base material shall be per ASTM and/or ANSI standards.

E. Materials and Workmanship

1. All materials shall be new, meet the requirements of the contract document and be identifiable as being specified or substitute products.
2. Materials that do not conform to the requirements of the contract documents, are not equal to approved samples or are unsatisfactory or unsuited to the purpose for which they are intended, will be rejected and shall not be installed.
3. All equipment shall be installed in accordance with the recommendations of the manufacturers.
4. Work performed under this Division shall be installed by craftsmen skilled in the trade involved, and apprentices as indicated in General Conditions.
5. Provide all control equipment for electrically operated equipment except when equipment is furnished with control equipment.
6. Provide all electrical work required for the service and connection of electrically operated and controlled equipment specified in other Divisions of the Specification.
7. All electrical power, signal, alarm, notification and communication systems shall be complete, tested and ready for use.
8. Defective work, whether the result of poor workmanship, use of defective materials, damage through carelessness, or other cause shall be removed within ten (10) days after written notice is given by the District's Representative, and the work shall be re-executed by the Contractor. The fact that the District's Representative may have previously overlooked such defective work shall not constitute total or partial acceptance of it.
9. The Contractor recognizes that the design is based upon the equipment and material specified by name or construction and the Contractor accepts full responsibility for assur

ing that the quality, utility and performance of a substitution equals or exceeds that of the specified item.

10. In no case shall a Bidder base his bid on a class of material or workmanship less than that required by the contract documents nor the governing codes and ordinances.

F. Checking and Testing Equipment by Contractors and Manufacturer's Representative:

1. All equipment shall be installed per the manufacturer's instructions. During construction contractor shall request supervisory assistance from equipment manufacturer's representatives so the equipment will be correctly installed. After installation, request the District's Representative to observe and see the equipment is in proper working order.
2. Manufacturer's representative shall review the overall system design relative to the proper application of his equipment in the particular system. He shall note conduit, wiring, control, location, and other relevant relationships, and furnish appurtenances necessary for satisfactory operation.
3. Before equipment start up, the manufacturer's representative shall submit to the District's Representative, a signed statement certifying to their inspection and noting that the equipment is properly installed and ready for operation.

1.5 PROJECT RECORD DOCUMENTS

A. Record documents shall conform to the Closeout Procedures of Division 01 and this section.

B. Keep up-to-date during the progress of the job through, one set of drawings indicating the Record installation. In addition to changes made during course of Work, show following by dimensions from readily obtained base line reference points:

1. Show exact layout of the equipment, pads, overhead or underground conduits, riser conduits and bus ducts in electrical rooms.
2. Show exact layout of the equipment, pads, overhead or underground conduits in outdoor equipment yards.
3. Show exact layout of the equipment, pads, feeder conduits and bus ducts in mechanical and utility rooms.
4. Show exact layout of the equipment, pads, and feeder conduits on the roof or outdoor areas.

C. Underground utility services, both inside and outside of buildings, shall be dimensioned from permanent structures, bench marks or property lines. Utility services outside of buildings shall also show depth of burial with reference to the finished ground floor elevation.

D. This set of drawings shall be kept on the project site at all times and shall be available for inspection by District’s Representative or Construction Manager.

E. Submit completed Drawings to District’s Representative for approval prior to authorization for final payment.

F. Record drawings shall be certified as to their correctness by the signature of the Contractor and shall be stamped or otherwise identified as record drawings.

G. At the completion of the project the Contractor shall submit record as-built drawings as specified in Division 01 and their electronic CAD files. Drawings shall incorporate all the District’s and Architect’s comments and represent completed as-built conditions.

1.6 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Instructions and Manuals: In accordance with requirements of Division 01 and as follows:

1. Prior to project closeout, furnish to the District’s Representative hard back 3-ring binders containing all bulletins, operation and maintenance instructions, parts’ lists, service telephone numbers and other pertinent information as noted in each Section for equipment fur

nished under Division 26. Binders shall be indexed into Division Sections and labeled for easy reference. Bulletins containing more information than the equipment concerned shall be properly stripped and assembled.

2. O&M manuals shall be in both hard copy format and electronic format. Electronic files must have searchable text for ease in locating specific information, i.e. no scanning of paper documents.
3. O&M's shall include the copy of approved submittal information so that the specific details and applications of each device for this project are available.
4. One month prior to request for final inspection, submit Operating and Maintenance manuals or as stated in Division 01.
5. Manuals shall be prepared to include the following:

    a. Section 1: A comprehensive table of contents and guide to the manuals contents and layout. This section shall enable the reader to comprehend the scope and purpose of the document and to identify readily where specific information can be obtained.
    b. Section 2: Contractual and Legal records including:
    c. Name and Address of the installation

        1) Details of IOR, District, Architect & Engineer's approvals
        2) Name and Contact details of the Design Team and Installing Contractors and associated sub- contractors
        3) Dates for Start of Installation, Substantial Completion, and Expiry of Warrantee period
        4) Copies of maintenance service contracts and contact details for local service company
        5) Copies of warrantees and bonds

    d. Subsequent Sections:

        1) Startup and Shutdown Procedures: Provide a step-by-step write-up of all major equipment. When manufacturer's printed start-up, troubleshooting and shut-down procedures are available, they shall be incorporated into the operating manual for reference.
        2) Operating Instructions: Written operating instructions shall be included for the efficient and safe operation of all equipment.
        3) Service Instructions: Provide the following information for all pieces of equipment:

            a) Recommended spare parts, including catalog number and the name, manufacturer's name and contact information, address and telephone number of local suppliers of factory representative.
            b) Maintenance instructions and recommended service maintenance schedule for all equipment. Provide sample maintenance record forms for each equipment type.
            c) Data sheets to show complete internal wiring, mechanical and electrical ratings and characteristics, catalog data on component parts whether furnished by equipment manufacturer or others, names, addresses and telephone numbers of source of supply for parts subject to wear or electrical failure, and description of operating, test, adjustment, and maintenance procedures.
            d) Where data sheets included in manual cover equipment, options, or other features not part of equipment actually furnished, line out these references or otherwise clearly mark so remaining text, diagrams, drawings, schedules, and similar information shall apply specifically to equipment furnished.
            e) Final submittals for equipment shall have final corrections included in the prints used for the manual.

1.7 TEMPORARY FACILITIES

A. Temporary Light and Power: Provided under requirements of Division 01.

B. All temporary facilities shall be removed at completion of project, with permanent facilities returned to proper working order.

1.8 REGULATIONS, CODES, PERMITS AND FEES

A. Conform to all rules, regulations, laws, and ordinances governing the area in which this construction occurs.

B. Obtain the required permits from the local authorities for this work and pay for all fees required by the City, County, State and Federal authorities for permits, inspections and review, including special agency construction and operating permits. Make corrections in the work as required by the District's Representative or Inspector to pass local regulations.

C. Provide local authorities with all notices relating to this Division.

D. Provide District, District's Representative and local Inspectors access to work at all times.

E. Contractor shall be responsible for all law violations caused by the work under this Division. Notify the District's Representative in writing when a discrepancy occurs between code requirements and work shown on drawings and resolve matter before proceeding with work.

F. Make application and pay for all certificates of inspection, taxes and permits required by Local, State or Federal Government agencies, public utilities, or other authorities having lawful jurisdiction. Deliver to the District's Representative any and all certificates of inspections, permits, and approvals that may be required by such authorities.

1.9 COORDINATION

A. Coordination activities shall conform to the Administrative Requirements of Division 01 and this section.

B. Cooperate with all other Divisions performing work on this project as necessary to achieve a complete neatly fitted installation for each condition. Consult the Drawings and Specifications to determine the nature and extent of work specified in other Divisions that adjoins, shares space with, or attaches to the work of this Division. Confer with other Divisions at the site to coordinate this work with theirs in view of job conditions to the end that interferences may be eliminated and that maximum headroom and clearance may be obtained. In the event that interferences develop, the District's Representative's decision will be final as to which Division shall relocate its work, and no additional compensation will be allowed for the moving of piping, ductwork, conduit or equipment to clear such interferences.

C. Identify congested conditions. Congested areas typically include ductwork, piping, electrical work, ceiling work, etc. Include all mechanical and utility rooms and congested areas in corridors, tunnels and similar spaces. Shop Drawings for Work in "tight" areas shall clearly indicate the solutions to space problems in coordination with Work in other Sections. Identification of space problems without solutions is not acceptable. Solutions to problems may include relocation or rerouting of existing equipment, pull box, conduit, piping, and etc. to allow installation of new work.

D. Arrange for raceway spaces, chases, slots, and openings in building structure during progress of construction, to allow for electrical installations.

E. Coordinate installation of required supporting devices in form work and set sleeves in poured-in-place concrete and other structural components as they are constructed.

F. Coordinate requirements for access panels and doors for electrical items requiring access that are concealed behind finished surfaces.

G. Cutting and Patching

1. The Contractor shall do all cutting of building materials, conduit, etc., as required for the installation of work.
2. No structural members shall be cut without the prior approval of the District's Representative. To gain approval to cut concrete, Ferro scan the affected area and submit scan results to Structural Engineer for review. Submit to District's Representative, drawings and details for the support of structure around the opening. If the standard structural details are to be used, then submit a plan that cross-references all penetrations against detail numbers for review. Otherwise, submit drawings, design, and calculations stamped by a Registered Professional Structural Engineer in the state of California. Any cutting and remedial support shall be done in a manner satisfactory to the District's Representative.
3. Patching of building structure, walls, floors, etc. during normal work progress shall be consistent with the Requirements of Division 01.
4. All patching of or repair of damage to completed work in place shall be done to meet with the approval of the District's Representative.
5. All cutting shall be performed with machine saw. Holes for pipes in concrete walls or floors shall be drilled with core drilling equipment.
6. Work in place that is subsequently cut is seen as evidence of the contractor's lack of field coordination during the shop drawing production phase. Because field coordination is a requirement of the contract, the contractor must bear all costs of cutting, patching and repair for corrective work.

1.10 LOCATION AND ROUTING

A. The Drawings are for reference only and indicate diagrammatically the desired location or arrangement of equipment, devices, lights, outlets, pull boxes, vaults/manholes, raceways, and etc. are to be followed as closely as possible. Judgment must be exercised in executing the Work so as to secure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference with structural and existing conditions. Exact locations necessary to secure proper conditions and results shall be determined at Project Site and shall be approved by the District's Representative.

B. Verify dimensions, correct location and electrical requirements of all equipment specified in other Divisions before proceeding with the roughing-in of connection.

C. Locations shown on architectural drawings or on wall elevations shall take precedence over electrical drawing locations.

D. Access to Equipment: Locate all electrical equipment and pull boxes to provide easy access for operation, repair, and maintenance. All code required clearances shall be maintained for accessing the equipment and its disconnecting means.

E. Locations of Openings: Locate all chases, shafts and openings required for the installation of the electrical Work during framing of the structure. Do any cutting and patching required due to improperly located or omitted openings with the approval of the district's Representative, who must also approve any additional changes resulting from relocation or omission of openings. Cutting or drilling in any structural member is prohibited without prior written approval of the District's Representative.

1.11 SEISMIC PROTECTION

A. Electrical equipment installation in any Seismic Design Category shall be protected from earthquakes per all applicable local and state Building Codes.

1. Protection criteria for equipment shall be a Horizontal Force Factor as prescribed by the CBC multiplied by the equipment weight considered passing through the equipment center of gravity in any horizontal direction.

2. Equipment shall be protected from earthquakes by rigid structurally sound attachment to the load supporting structure unless vibration isolators are required to eliminate the unacceptable structure transmitted noise and/or vibration.
3. The force factor and anchorage shall be determined by calculations performed by a professional Structural engineer registered in the state whether the isolators are present or not and shall be verified by the seismic restraint vendor.
4. Equipment requiring vibration isolators shall be furnished with protected spring isolators or separate seismic restraints as required. Seismic snubbers and protected spring isolators shall be seismically rated in three principal axes by independent testing laboratory or analysis by an independent professional Structural engineer.

B. Contractor shall be responsible to provide seismic restraint systems and supporting concrete pads for the entire project.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver equipment, fixtures, devices and conduits with factory-fabricated containers and protective means. Maintain containers and protective means through shipping, storage, and handling to prevent damage and to prevent exposure to dirt, debris, and moisture.

1. Perform all handling and shipping in accordance with manufacturer's instructions.
2. Do not deliver equipment/materials to the jobsite before they are ready for installation, unless properly secured and safe storage areas are provided.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect equipment from dirt, water, construction debris, and traffic.

C. Handling: Handle in accordance with manufacturer’s written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed and shall be replaced with new units.

1.13 DEFENITIONS

A. “Approved Equal” means any equipment or material which in the opinion of the architect, is equal in quality, durability, appearance, strength, design and performance to the equipment or material specified and will function adequately in accordance with the general design.

B. “Authority Having Jurisdiction” or “AHJ” shall mean the building department, fire department, Inspector of Record (IOR), Division of State Architect (DSA) or other authority having legal jurisdiction relevant to the specific work being described in the City or State where the project is located.

C. “Concealed, Interior Installations” Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in wall conduits.

D. “Concealed, Exterior Installations” Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

E. "Connect": Shall mean make final electrical connections for a complete operating piece of equipment.

F. “Contract Documents” or “Documents” shall mean the latest version of all drawings and specifications prepared by the Architect, Engineers and Consultants.

G. “Equal”: Shall be of the same quality, appearance and utility to that specified, as determined by the District’s Representative. Contractor bears the burden of proof of equality.

H. “Exposed, Exterior Installations” Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include equipment yards or rooftop locations.

I. “Exposed, Interior Installations” Exposed to view indoors. Examples include finished occupied spaces and electrical equipment rooms.

J. “Finished Spaces” Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

K. “Furnish” means purchase, store and deliver the specified material, equipment or other items to project site or the person and party indicated.

L. "Install": means to physically install the equipment or other items in-place and in readiness for regular operation.

M. “Provide” means to supply, erect, install and connect up completely, in readiness for regular operation, the particular work referred to.

1.14 TRAINING

A. Furnish a period of sixteen (16) hours (4 – 4-hour sessions) for the necessary training programs and instructions to District’s personnel, unless indicated otherwise in individual specification sections.

1.15 WARRANTY

A. Conform to the requirements of “Warranties” as stated in Division 01 specifications.

B. Unless otherwise noted within a section, under special warranty each complete system shall be warranted by the Contractor for the period referenced in Division 01. Each system shall be free of defects of materials and workmanship and shall perform satisfactorily under all conditions of load or service.

1. The warranties shall provide that all additional controls, protective devices or equipment provided as necessary to make the system or equipment operate satisfactorily and any faulty materials or workmanship shall be replaced or repaired.
2. On failure of the warrantor to do the above after written notice from District, the District shall have the Work done at the cost of the warrantor.

C. Provide new materials, equipment, apparatus and labor to replace that determined by District to be defective or faulty within the warranty period.

D. Unless otherwise noted, warranties shall commence upon the District’s final acceptance of the project.

1.16 COMMISSIONING

A. Commissioning requires the participation of Division 26 work to ensure that all systems are operating in a manner consistent with the Design Intent. The general commissioning requirements and coordination are detailed in Division 01 and Division 26. This Division shall be familiar with all parts of Division 01 and Division 26 and the commissioning plan issued by the Commissioning Authority and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

B. The contractor is responsible for assisting the district throughout the entire commissioning process.

C. The work is not complete until the commissioning and District's Representative have signed off on the commissioned systems.

PART 2 - PRODUCTS

2.1 GENERAL

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

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified. A prior written approval is required for all items including any substitutions allowed for use on the project.
2. Whenever possible, all materials and equipment used in the installation of the work shall be of the same brand or manufacturer for each class of material or equipment.

B. Construction of all electrical equipment such as unit substation, switchboard, motor control center, generator, panel board, transformer and similar equipment shall meet local seismic code requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to bidding visit the site and determine all existing conditions affecting work of this Division. The Contractor shall thoroughly review the locale, working conditions, conflicting utilities and the conditions in which the electrical work will take place. Verify all existing conditions in the field. No allowances will be made subsequently for any costs that may be incurred because of any error or omission due to failure to examine the site and to notify the District's Representative of any discrepancies between Drawings and Specifications and actual site conditions.

B. The location and elevation of the utilities, existing ductwork, piping, conduit, or equipment are that which can be determined from available information and its accuracy cannot be guaranteed. Exact location and elevation of these items shall be verified by the Contractor prior to excavation, demolition, or installation of any portion of the work indicated. Exercise special care when excavating at or near the general location of underground utilities to avoid damage to the utility services, as well as to ensure worker safety.

C. Any connections to or relocation of any existing utility line requiring temporary discontinuance of utility services which are in active use shall be scheduled and coordinated with the utility company and the District's Representative. In no case shall the services be left disconnected at the end of a working day or weekend unless authorized by representatives of the utility company and the District. Any existing utility service damaged shall be repaired to the satisfaction of the District's Representative.

D. Examine all Drawings and Specifications to familiarize with the type of construction to be used, and the nature and extent of work of other trades.

E. Observe the conditions under which deliveries of materials and equipment shall be made and under which such materials and equipment can be stored and shall include adequate provision in the bid proposal.

3.2 FIELD VERIFICATION

A. All dimensions, locations of equipment and connections to utilities or pre-existing equipment shall be verified in field prior to construction and installation.

B. All roughing in construction dimensions shall be made from architectural plans where discrepancies may exist.

C. Architectural plans will hold precedence over electrical plans as to location of partitions, devices and equipment locations.

D. Measurements in existing buildings shall take precedence over all other plans with regards to identifying location of existing installations.

3.3 PROVISIONS FOR FUTURE INSTALLATIONS

A. At the start of the project, meet with the District's Representative to obtain information regarding allowable sleeve or penetration spacing and size. Provide all sleeves, inserts, and openings necessary for the installation of the Electrical and communications Work.

B. Where any Electrical work cannot be installed as the work progresses, the Contractor shall provide and arrange for the pads, sleeves, inserts, and any provisions as necessary to permit installation of the omitted work during later phases of construction. This field coordination work shall be completed prior to structural shop drawings and shall follow the principles set forth in the meeting referenced above. Arrange for and lay out any chases, holes, or other openings that must be provided in masonry, concrete or other work.

C. The Contractor shall be responsible for being aware of the nature and arrangement of the materials and construction to which the work attaches or passes through, and shall propose support and penetration details that are consistent with maintaining the integrity and performance of the construction such as, but not limited to, fire- resistive construction, acoustically rated construction, vibration isolated construction, water tight construction, fire proofed construction, and isolated construction.

D. This work shall be incorporated into the initial shop drawing review of the construction (wall, floor, roof, etc.) that is affected so that the District's Representative may review the impact of the holes.

E. The contractor shall bear the cost of time and materials for the District's Representative to re-analyze the construction if the original spacing principles are not adhered to, for whatever reason.

F. Once the structural shop drawings are returned with no exception taken, the contractor shall bear the cost of time and materials for the District's Representative to review the appropriateness of cutting or drilled holes in planned or existing construction.

3.4 INSTALLATION

A. Install electrical equipment as specified in individual specification sections, and in accordance with the manufacturer's instructions, code requirements, and required access clearances.

B. No material, device or equipment shall be shipped to site unless shop drawings have been approved for such, prior to shipment.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install raceways, boxes and lights to allow maximum possible headroom where specific mounting heights are not indicated.

E. Rough-in locations for fixtures and equipment shall be determined from the unit itself or from the approved shop drawings.

F. Arrange for necessary openings to allow for admittance of equipment. Where equipment cannot be installed as structure is being erected, provide and arrange for building-in of boxes, sleeves, or other devices to allow later installation.

G. Install equipment to permit easy access for normal maintenance.

1. Maintain easy access to switches, motors, drives, pull boxes, receptacles, etc.
2. Notify the District's Representative in writing of relocation items which interfere with access.

H. Suspended raceways and equipment shall be installed in accordance with the Applicable local, state and national Building Codes.

I. Hangers, Inserts, Supports and bases:

1. Provide all necessary anchoring devices and supports as required and stated elsewhere:

   a. Use structural supports suitable for equipment, or as indicated.
   b. Check loadings and dimensions of equipment with shop drawings.
   c. Do not cut or weld to building structural members.

2. Provide required structural members, hangers, supports and inserts to keep cable trays and conduits in proper alignment and prevent transmission of injurious thrusts and vibrations. Where supported from concrete construction, do not weaken concrete or post-tension strands or penetrate waterproofing. Hangers and supports shall be finally adjusted in vertical and horizontal direction under operating conditions.
3. Metal deck roof systems shall not be used for the support of hangers, inserts, etc.
4. Provide all metal bases and supports, not part of the building structure as required. Materials and equipment furnished or provided under this Division shall be as described for similar work under other Divisions.
5. Coordinate the location of inserts with Division 03 prior to pouring of concrete.

3.5 PROTECTION AND STORAGE

A. All stock-piled material shall be placed on pallets and protected from weather and from entry of foreign material and construction dust by plastic. All stored materials and equipment shall be carefully inspected and cleaned prior to installation and replaced with new material or equipment if found to be damaged, corroded, etc.

B. Equipment which is observed to be exposed to the weather, dirt or construction debris can be interpreted by the District's Representative as defective equipment under this clause.

3.6 TOOLS AND EQUIPMENT

A. Furnish all tools and equipment necessary for the proper installation, protection and upkeep of the work.

3.7 EXCAVATION, TRENCHING AND BACKFILL

A. Do all excavation, trenching and backfill required to install the work in this Division.

B. Coordinate trenching and backfill required for the installation of this Division. Repair or replace all roadway, sidewalk, pavements, parking lots, Asphalt & Concrete surfaces, gutters, curbs and other work incidental thereto. Dispose of excavation material per other Divisions of specifications.

C. Provide barricades, signs, lanterns, shoring, sheeting and pumping as part of Work in this Division as required to insure safe conditions. Comply with OSHA requirements.

D. Shore all trenches and excavations as necessary to maintain the banks of excavations and to prevent any sloughing, caving-in or damage of any kind.

E. Trenching: Subject to the requirements of the civil engineer, dig trenches straight, true to line and grade with sides and bottoms smoothed of any rock points. All trenches shall be sloping away from the building. All trenching required for utility company shall comply with individual utility company requirements.

F. Excavation: All excavations shall be inspected by the District's Representative, IOR and approved before placing of any conduit or pull box. Bury conduits outside the building to a depth of not less than 24 inches below finish grade unless otherwise noted and comply with CE 305.

G. Backfilling: Do not backfill until final inspection and approval for the conduit installation by the District's Representative. Any imported backfill material required shall be approved by the Architect responsible for certification of compaction.

3.8 DEMOLITION

A. General:

1. The work involves demolition of existing conduit, conductors and equipment.
2. Refer to contract documents for any demolition, relocation, removal or rerouting of existing conduits and equipment.
3. All demolished or Contractor removed materials become the property of the Contractor, unless otherwise indicated. Contractor shall be responsible for removing such materials from the job site.

B. Equipment: All the existing equipment to be removed from site & building shall be disassembled or cut into pieces to allow removal through available existing openings.

C. Conduits (feeder and branch): Conduits shall be capped, and wires/cables removed for all abandoned installations.

3.9 PROTECTION AND CLEANING

A. Protection: Fully protect all finished parts of the materials and equipment against physical damage from whatever cause during the progress of the work and until completion.

B. During construction, cap all conduits so as to prevent the entrance of sand and dirt.

C. Clean premises of all excess construction material and debris caused by work, in accordance with Division 01.

D. Surfaces shall be left clean, debris shall be removed, and equipment shall be furnished in prime coat finish unless otherwise specified.

E. Clean exterior of conduit and equipment exposed in complete structure. Remove rust, paint overspray, fireproofing overspray, plaster and dirt by wire brushing; remove grease, oil and similar materials by wiping with clean rags and suitable solvents.

F. Equipment, devices and Other Items with Factory Finish: Remove grease, oil, paint overspray, fireproofing overspray, gypsum board muds platters and leave surfaces clean.

3.10 CONCRETE

A. General: All concrete required shall be provided as specified in Division 03, CONCRETE.

B. Concrete Pads:

1. Provide concrete pads for installation of all floor mounted equipment whether indicated or not on drawings. The concrete pads shall be sized to carry the weight of the equipment and allow the proper installation of anchorage bolts and any vibration isolation devices.
2. Construct concrete pads of dimensions indicated, but not less than 3 inches high (where required, deeper pads shall be used to meet the equipment anchorage requirements) and extending 3 inches beyond edge of the supported equipment or as required.
3. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
4. Anchor equipment to concrete pad according to equipment manufacturer's written instructions and according to applicable seismic codes.
5. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
6. Provide provisions for water drainage by providing slope at the concrete pad.

C. Use 2500-psi, 28-day compressive-strength concrete and reinforcement.

3.11 SEISMIC RESTRAINTS

A. Provide seismic restraints and supports for equipment and work as specified in the Specification Section 26 05 48, this and other specification sections, and as shown on drawings.

1. Seismic restraints and supports shall be installed directly after installation of any work requiring them, to avoid concealment or difficulty of access.
2. Contractor shall be responsible for any costs and delays associated with gaining access to any installation needing restraints or supports.

3.12 PENETRATIONS

A. Acoustical: All penetrations through acoustically treated walls shall be sealed with non-hardening resilient acoustic sealant.

B. Waterproofing:

1. All penetrations through exterior walls and beneath slabs-on-grade shall be sealed with weatherproofing material.
2. All below grade conduit penetrations through the walls shall be individually sealed with Link-Seal or equal.
3. Provide flashings at exterior wall and roof penetrations. Caulk watertight penetrations of above grade walls, roofs and floors.

3.13 FIRE STOPPING

A. Provide sealing or stuffing material or assembly in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat and hot gases through fire rated construction.

B. Materials and Products:

1. Provide material listed in the UL Fire Resistance Directory for the UL system involved to achieve fire ratings of adjacent construction.
2. Materials shall have been tested to provide fire rating at least equal to that of the construction.
3. All fire stopping products shall be from a single manufacturer.

C. Environmental Requirements:

1. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
2. Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.
3. Provide ventilation in areas to receive solvent cured materials and as required by manufacturer.

3.14 IDENTIFICATION

A. The Contractor shall identify all conduit, cabling, devices, and equipment in accordance with SECTION 26 05 53 – IDENTIFICATION for ELECTRICAL SYSTEMS.

B. The Contractor shall submit a schedule for equipment identification.

3.15 SETTING OF PROTECTIVE DEVICES

A. Prior to final completion of the Project, set all protective device relays and internal settings to provide adjustment between upstream and downstream protective devices. Settings shall be based on the accepted coordination study.

3.16 OPERATIONAL TESTS

A. Before acceptance tests are performed, demonstrate to the District's Representative that all systems and components are complete and fully operational.

B. Perform operational tests on all equipment to determine compliance with Specifications.

3.17 FINAL INSPECTION

A. As the work nears completion, review the requirements of the Contract Documents, inspect the work and inform all parties involved in work to be corrected or completed before the project can be deemed substantially complete.

B. When the project is substantially complete, notify the District's Representative in writing of this fact, listing those items of work remaining incomplete, the reason for incompleteness, and the anticipated date that all remaining work will be completed. Carry out own final inspection and be satisfied that the work is complete. Final inspection of the project will then be scheduled by the District's Representative.

C. The District's Representative reserves the right to cancel and reschedule the inspection in the event considerably more work remains to be completed or corrected than indicated in the written request for inspection.

D. All items not completed or found not complying with drawings or specifications by the District's Representative will be identified in an inspection report by District's Representative.

E. Correct all items on inspection report. Make the correction and initial and date each item on the report after corrections have been completed.

3.18 PROJECT CLOSE-OUT

A. Prior to requesting District's Representative's inspection for certification of substantial completion, complete the following and list known exceptions in request:

1. Obtain final inspections and approvals from all governmental jurisdictions that are required for the project.
2. Submit record drawings, maintenance manuals, warranties, and similar final record information.

3. Deliver tools, spare parts, extra stocks of materials, and similar physical items to the District.
4. Complete start-up, testing and demonstration of systems to the satisfaction of the District's Representative that the entire installation is complete, properly adjusted and is in proper operating condition.
5. Complete final cleaning requirements.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.

2. Connectors, splices, and terminations rated 600 V and less.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: Indicate type, use, location, and termination locations.

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.01 COPPER BUILDING WIRE

A. Description: Flexible, insulated, and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are limited to the following:

   1. Southwest Wire

   2. American Insulated Wire

   3. Encore Wire Corp.

   4. Approved equal

C. Standards:

   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

   2. RoHS compliant.

   3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 AND ASTM B 496 for stranded conductors.

E. Conductor Insulation:

   1. Type THHN and Type THWN-2: Comply with UL 83.

   2. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.

   3. Type XHHW-2: Comply with UL 44.

2.02 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

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

1. 3M Electrical Products.

2. AFC Cable Systems; a part of Atkore International.

3. Ideal Industries, Inc.

4. ILSCO.

5. O-Z/Gedney; a brand of Emerson Industrial Automation.

C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.

2. Type: One/Two hole with standard]/long barrels.

3. Termination: Compression/Crimp.

D. Lighting Whips

1. The use of MC cable is permitted for lighting installations. The length of the whip shall not exceed 6 feet.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper for all feeder Conductors and shall be solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

C. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN/THWN-2, single conductors in raceway; Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway; Type XHHW-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway; Type XHHW-2, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in conduits in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.04 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. It is the intent of District and the Engineer that no splices shall be made in the run and shall be terminated only at equipment terminals, if this is impractical it will be reviewed and approved on a case-by-case basis.

C. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

D. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.05 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.

3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.07 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according UL listing.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.

2. Foundation steel electrodes.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Final Report: A final report shall be submitted summarizing the data, assumptions computation results, conclusions, and recommendations. The final report shall include the computation test results witnessed and signed by IOR.

1.03 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:

a. Test wells.
b. Ground rods.
c. Grounding arrangements and connections for separately derived systems.

2. Instructions for periodic testing and inspection of grounding features at test wells, ground rings and grounding connections for separately derived systems based on NETA MTS, NFPA 70B and 2022 CEC Article 250.

a. Tests shall determine if ground-resistance or impedance values remain within speci

fied maximums, and instructions shall recommend corrective action if values do not.

b. Include recommended testing intervals.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.02 MANUFACTURERS

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

1. Burndy; Part of Hubbell Electrical Systems.

2. ERICO International Corporation.

3. ILSCO.

4. O-Z/Gedney; a brand of Emerson Industrial Automation.

2.03 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V and 5kv as applicable unless otherwise required by applicable Code or authorities having jurisdiction.

B. Conductors must be large enough to handle any anticipated faults without fusing (melting). Table 1, which is derived from IEEE 80-1986, IEEE Guide for Safety in AC Substation Grounding, lists the maximum allowable fault current (in kA) for various conductor sizes and fault durations.

C. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.

2. Stranded Conductors: ASTM B 8.

3. Tinned Conductors: ASTM B 33.

4. Bonding Cable: 28 Kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.

5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

D. Grounding Bus: Predrilled rectangular bars of annealed copper, 1 inch by 24 inches in cross section, with holes suitable for conductors installed spaced 3 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.04 CONNECTORS

A. Note: The connections between conductors and the main grid, and between the grid and ground rods, are very important as the conductors themselves in maintaining a permanent low-resistance path to ground. Must consider the type of bond the connection creates with the conductor or ground rod and temperature limits. The most frequently used grounding connections are mechanical pressure-type (bolted, compression, and wedge) and exothermically welded. Pressure-type connections produce a mechanical bond between conductor and connector. This connection either holds the conductors in place or squeezes them together,

providing surface-to-surface contact with the exposed strands. The project design requires exothermically welded process fuses the conductor ends together to form a molecular bond between all strands of the conductor. Temperature limits are important considerations. How effectively a connection carries current indicates how well it will maintain low resistance. IEEE 80 rates the maximum allowable temperature limits for both pressure-type and welded connections. IEEE 837 gives additional information. All electrical grounding system shall be provided with Exothermic weld.

B. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

E. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.

F. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

G. Cable-to-Cable Connectors: Compression type, copper.

H. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.

I. Conduit Hubs: Mechanical type, terminal with threaded hub.

J. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

K. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.

L. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.

M. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

N. Straps: Solid copper, copper lugs. Rated for 600 A.

O. U-Bolt Clamps: Mechanical type, copper, terminal listed for direct burial.

P. Water Pipe Clamps:

1. Mechanical type, two pieces with stainless-steel bolts.

a. Material: Die-cast zinc alloy.
b. Listed for direct burial.

2. U-bolt type with malleable-iron clamp and copper ground connector.

2.05 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, sectional type, 3/4 inch by 10 feet. For maximum efficiency, rods should be placed no closer together than the length of the rod. Normally, this is 10 ft. Each rod forms an electromagnetic shell around it, and when the rods are too close, the shells actually interfere with each other. Sectionalizing type ground rods are required.

B. Ground Plates: 1/4-inch-thick, hot-dip galvanized.

2.06 GROUND BOXES

1. Ground Boxes – acceptable manufacturers are limited to the following:

a. Christy Concrete
b. Jensen Precast

PART 3 - EXECUTION

3.01 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, AWG as indicated on the drawings as minimum.

1. Bury at least 24 inches below grade, comply with CEC Article 305.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.

2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.

3. Connections to Ground Rods at Test Wells: Bolted connectors.

4. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.03 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

3.04 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70 & 2022 CEC

1. Feeders and branch circuits.

2. Single-phase motor and appliance branch circuits.

3. Three-phase motor and appliance branch circuits.

4. Flexible raceway runs.

5. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

3.05 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

3.06 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a certified field-testing company.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells and at individual ground rods. Make tests at ground rods before any conductors are connected.

   a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
   b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their

depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports. All test shall be witnessed by IOR and shall sign the test reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, provide additional sectionalizing ground rods until required test values are obtained.

3.07 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain and to use of grounding systems.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Boxes, enclosures, and cabinets.
4. Handholes, pull boxes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior duct banks, vaults/pull boxes, and underground utility construction.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Seismic Qualification Data: Certificates, for enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Wheatland Tube Company.
    b. Allied Tube & Conduit; a part of Atkore International.
    c. Republic Conduit
    d. O-Z/Gedney; a brand of Emerson Industrial Automation.
    e. Western Tube and Conduit Corporation.

2. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. GRC: Comply with ANSI C80.1 and UL 6.
4. IMC: Comply with ANSI C80.6 and UL 1242.
5. PVC-Coated Steel Conduit: PVC-coated [rigid steel conduit] [IMC].

    a. Comply with NEMA RN 1.
    b. Coating Thickness: 0.040-inch, minimum.

6. EMT: Comply with ANSI C80.3 and UL 797 with Compression fittings (set screw type not acceptable).
7. FMC: Comply with UL 1; zinc-coated steel.
8. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings: Comply with NEMA FB 1 and UL 514B.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following (District Standard):

a. Steel City
b. O-Z Gedney

2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Fittings, General: Listed and labeled for type of conduit, location, and use.
4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
5. Fittings:

a. Material: die cast.
b. Type: compression type only (set screw types not permitted).

6. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
7. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

C. Joint Compound for IMC, GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit; a part of Atkore International.
b. PW Eagle
c. Calbond; a part of Atkore International.
d. CANTEX INC.
e. Carlon

B. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
2. LFNC: Comply with UL 1660.

C. Nonmetallic Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit; a part of Atkore International.
b. PW Eagle
c. Calbond; a part of Atkore International.
d. CANTEX INC.
e. Carlon

2. Fittings, General: Listed and labeled for type of conduit, location, and use.
3. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
4. Fittings for LFNC: Comply with UL 514B.
5. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 FLEXIBLE METALLIC TUBING

1. Flexible metallic tubing shall be steel only and no smaller than 3/4 inch in size. Shall be used only between junction boxes where the installation does not permit the use of EMT. Flexible metallic tubing shall not be used for home runs.

2.4 METAL WIREWAYS AND AUXILIARY GUTTERS

D. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel City
2. Appleton
3. Circle AW.
4. Hoffman; a brand of Pentair Equipment Protection.

E. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1/Type 3R/Type 4 Type 12 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel City
2. Appleton
3. Circle A W
4. Hoffman

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

J. Gangable boxes are allowed.

K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1/Type 3R/Type 4/ Type 12 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

L. Cabinets:

1. NEMA 250, Type 1/Type 3R/Type 12 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.4 HANDHOLES AND PULL BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Christy Concrete
2. Jensen Precast

B. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed outdoor Conduit: GRC/IMC with threaded fittings.
2. Concealed Conduit, Aboveground: GRC/IMC/EMT.
3. Underground Conduit: RNC, Type EPC-40-PVC/Type EPC-80-PVC.
4. Connection to Vibrating Equipment (Including Transformers Motor-Driven Equipment): LFMC/LFNC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated.

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Severe Physical Damage: GRC/IMC. Raceway locations include the following:
    a. Mechanical/storage/electrical rooms.
    b. Gymnasiums.
3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations. Whips are limited to six feet.
5. Damp or Wet Locations: GRC/IMC.
6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
7. MC cable maybe be used for lighting whips, no longer than 6’ in length.

C. Minimum Raceway Size: 3/4-inch trade size.
D. Flexible conduit shall only be used between junction boxes where the installation doesn’t permit EMT. Flexible conduit is not permitted for home runs. Minimums size shall be ¾”.

E. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, cast-metal fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

3.2 INSTALLATION

A. Provide Hangers and Supports for Electrical Systems.
B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.
D. Do not fasten conduits onto the bottom side of a metal deck roof.
E. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
F. Arrange stub-ups so curved portions of bends are not visible above finished slab.
G. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
H. Make bends in raceway using large radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
I. Install conduits parallel or perpendicular to building lines.
J. Support conduit within 12 inches of enclosures to which attached.
K. Raceways Embedded in Slabs: No raceways shall be embedded in concrete slab or equipment pads.
L. Below ground conduits shall transition to Rigid Steel at rise through concrete and where attached to permanent structure or temporary building.

1. Use EMT, IMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

M. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

N. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

O. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

P. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

R. Install raceway sealing fittings at accessible locations according to NFPA 70 & NFPA 72 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

S. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where an underground service raceway enters a building or structure.
2. Conduit extending from interior to exterior of building.
3. Where otherwise required by NFPA 70.

T. Expansion-Joint Fittings:

1. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
2. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

U. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

V. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.

W. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

X. Locate boxes so that cover or plate will not span different building finishes.

Y. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

Z. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

AA. Ground Boxes:

Ground boxes shall be installed flush with finished grade with at least 6 inches of ¾ inch gravel at the base for drainage. In all cases lids shall be traffic rated and labeled as to the content of the box. Where the conduit enters the box, the PVC shall be flush with the finished surface of the box and fitted with a bell end. The conduit shall be mortared in place. The conduits shall be evenly spaced and in a straight line. All cable runs shall be securely attached to the wall via a cable rack.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Refer to specification section 26 05 43.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND PULL BOXES

A. Refer to specification section 26 05 43.

B. Underground Conduit Runs

The use of PVC schedule 40 or 80 is permitted for underground conduit runs but must transition to rigid conduit at the riser to attach to any permanent structure or temporary building.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements of UL for "Penetration Firestopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 43

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks, and in single duct runs.
2. Vaults, Pull Boxes and Handholes boxes.
3. Rigid steel conduit
4. Rigid Intermediate Conduit
5. Rigid non-metallic conduit
6. PVC coated metal conduit.
7. Hand holes/Pull Boxes
8. Damp proofing material
9. Duct sealing compound.

B. Related Work: Refer to all other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

C. System Description: Conduit and duct routing, handhole and manhole locations are shown in approximate locations unless dimensions are indicated. Route and locate interconnected system of encased conduits, ducts, hand holes, and manholes to complete the underground distribution system.

1. Use rigid non-metallic PVC Schedule 40/80 conduit for all underground and concrete encased applications.

2. Underground conduit runs but must transition to rigid conduit at the riser to attach to any permanent structure or temporary building within 5’ of the building.

3. Use rigid steel conduits for all elbows and bends.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified.

1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.

2. ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

3. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures

4. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures

5. ASTM C1037 - Standard Practice for Inspection of Underground Precast Concrete Utility Structures

6. IEEE C2 - National Electrical Safety Code

7. NFPA 70 - National Electrical Code (NEC) with California Amendments

8. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit

9. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing

10. UL 651A - Type EB and A Rigid PVC Conduit and HDPE Conduit

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 26 00 00 – Common Work Results for Electrical, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical characteristics, and indicating compliance with all listed standards.

a. Thickness of all metals
b. Reinforcing iron dimensions and placement
c. Concrete dimensions.
d. Dimensions or pull irons and gages.
e. Cable rack irons dimensions and mounting method.
f. Interior dimensions.
g. Method of construction
h. Duct-bank materials, including separators and miscellaneous components.
i. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
j. Accessories for manholes, vaults, pull boxes and handholes, boxes, and other utility structures.
k. Warning tape.

B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Shop drawings shall Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:
1. Duct entry provisions, including locations and duct sizes.
2. Reinforcement details.

3. Frame and cover design and manhole frame support rings.
4. Ladder details.
5. Grounding details.
6. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
7. Joint details.
8. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
9. Shop Drawings: Indicate dimensions, “Butterfly” layouts, size and locations of openings, and accessory locations for precast manholes.
10. Submit manufacturer's installation instructions.

1.04 INFORMATIONAL SUBMITTALS

A. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.

1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.

B. Product Certificates: For concrete and steel used in precast concrete manholes and handholes, as required by ASTM C 858.

C. Qualification Data: For professional engineer.

D. Source quality-control test reports.

E. Field quality-control test reports.

F. Submit Certification/analysis indicating compliance with H2O truck loading and applicable Seismic Design Category in conformance with CBC requirements.

1.05 QUALITY ASSURANCE

A. All products shall be UL labeled for their intended use.

B. Comply with the current edition of Northwestern Design Standards, including IT/IS Standards for Low Voltage systems pathways.

C. Comply with ANSI C2.

D. Comply with NFPA 70.

1.06 COORDINATION

A. Coordinate with existing underground utilities and structures. Obtain underground utility survey from Architect prior to excavation.

B. Coordinate with work indicated on Architectural, underground existing utilities and other consultants' drawings.

C. Coordinate layout and installation of ducts, pull boxes and handholes with final arrangement of all utilities, site grading and surface features as determined in the field.

D. Coordinate elevations of ducts and duct-bank entrances into vaults, pull boxes and handholes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to pull boxes and handholes and as approved by Architect.

E. Interruption of existing electrical service: do not interrupt electrical service to facilities occupied by the School or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify the District & the Architect no fewer than 21 calendar days in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without the District's written permission.

3. District's lock-out/tag-out procedures shall be used with contractor-controlled locks and tags.

4. Comply with NFPA 70E.]

PART 2 - PRODUCTS

2.01 RIGID STEEL CONDUIT

A. Galvanized, comply with ANSI C80.1

2.02 RIGID NON-METALLIC CONDUIT

A. RNC: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.03 PVC COATED METAL CONDUIT

1.1 NONMETALLIC DUCTS AND DUCT ACCESSORIES.

A. Underground ducts:

1. PVC Conduit for direct burial Schedule 40, UL Labeled for 90-degree C Cables. Fittings shall be Schedule 40, solvent type, from same manufacturer.

2. Sleeves shall be Schedule 40 PVC conduit, 6-inch diameter.

3. Marker Tape shall be Plastic, vinyl or mylar, 6-inch wide and orange in color for telecommunications and labeled to indicate cable type. ARNCO Corp or equal.

4. Lesser Grade conduit and fittings are disallowed.

B. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.

2. Warning Tape: Underground-line warning tape specified in Division 26 Section "Identification for Electrical Systems."

3. Concrete Warning Planks: Nominal 12 by 24 by 3 inches in size, manufactured from 6000-psi concrete.

a. Mark each plank with "ELECTRIC" in 2-inch- high, 3/8-inch-deep letters.

2.04 HANDHOLES/PULL BOXES (Sizes as indicated on drawings)

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

1. Jensen Precast

2. Christy Concrete

B. Description: Handhole comprising modular, interlocking sections complete with accessories.

1. Loading: ASTM C857, Class A-16

2. Shape: Rectangular or as indicated on Drawings.

3. Nominal inside Dimensions: 17”x 30”

4. Inside Depth: 12”, provide extension rings to match required depth.

5. Wall Thickness: 4”

6. Utility underground pull box with extension rings as required to maintain elevation (Pull box Sizes as indicated on drawings) with steel Traxplate bolt down slip resistance cover lid, installation of pull box shall be per manufacturers installation procedures. Pull box shall be placed on a minimum 6" crushed ¾" gravel rock for ease of installation & even load distribution. Cover marked "telecom" or "electric" as applicable.

7. Ground Well box: J & R Concrete No. E6 – RT Series or approved equal.

8. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.

9. Where the conduit enters the box, the PVC shall be flush with the finished surface of the box and fitted with a bell end. The conduit shall be mortared in place. The conduits shall be evenly spaced and in a straight line. All cable runs shall be securely attached to the wall via a cable rack.

C. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2- inch ID by 2-3/4 inches deep, flared to 1-1/4 inches minimum at base.

1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.

2. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms shall be available in lengths ranging from 3 inches with 450-lb minimum capacity to 20 inches with 250-lb (minimum capacity. Top of arm shall be nominally inches wide, and arm shall have slots along full length for cable ties.

D. Duct-Sealing Compound: Non-hardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F (2 deg C). Capable of withstanding temperature of 300 deg F (150 deg C) without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

E. Cover Hooks: Heavy duty, designed for lifts 60 lbf (270 N). Two required.

2.05 SEAL – SLEEVE ASSEMBLIES

A. Products: "Link-Seal" ® by GPT Industries.

B. Exterior Wall or Stub-Ups through Floor: Modular seal assembly to provide a hydrostatic seal, using mechanical interlocking synthetic rubber links shaped to fill the annular opening between the conduit and the wall. Pressure plate shall be reinforced nylon-polymer. Hardware shall be stainless steel.

C. Sleeves shall be Schedule 40 galvanized steel pipe.

2.06 DAMPPROOFING MATERIAL

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

1. A.C. Horn Company "Dehydratine No. 4".

2. Sonneborn Sons, Inc. "Hydrocide 648".

3. Toch Brothers "RIW Marine Cement Semi-Mastic"

2.07 FOAM SEALANT

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

a. Polywater Corporation – FST Foam Sealant high expansion foam duct sealant to keep water, acids, dust, gases, insects and rodents entering the ducts. Comply with 2014NEC 225.27,230.8 and 300.5(G) Raceway seals. Sealing shall be completed to form waterproof seal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Thoroughly examine site conditions for acceptance of pull-box or manhole installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

A. The Contractor shall prepare and be responsible for an excavation in accordance with those shown on Vault/Manhole/pull boxes shop drawings. Prior to placing the precast substructure into the excavation, the Contractor shall provide base material at the bottom of the excavation. The base material shall be level and compacted to the proper elevation in conjunction with the conduit and the conduit entrance of vault/manhole as designated on the utility plans.

3.03 UNDERGROUND DUCT APPLICATION

A. Products and installation options in this Article are examples only. Coordinate with Drawings and edit to suit Project. See the Underground Raceway Application Chart and "Product Selection and Application Considerations" Article in the Evaluations. Coordinate with products listed in Part 2 "Nonmetallic Ducts and Duct Accessories" Article.

B. Verify application in paragraph below with utility if ducts are for service conductors provided by utility.

C. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40 PVC, in concrete-encased duct bank, unless otherwise indicated.

D. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40 -PVC, in direct-buried duct bank, unless otherwise indicated.

E. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40 PVC, in concrete-encased duct bank, unless otherwise indicated.

F. Underground Ducts for Telephone, Communications, or Data Circuits: RNC, NEMA Type EPC-40 PVC, in direct-buried duct bank, unless otherwise indicated.

G. Trenchless technology involving horizontal jacking, or boring or directional boring is often used for crossing obstructions such as described in paragraph below. Trenchless techniques are not specified in this Section but are described in the Evaluations.

H. Underground Ducts Crossing Paved Paths/Walks and Driveways: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

3.04 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes, vaults and Pull Boxes for 600 V and Less, Including Telephone, Communications, and Data Wiring:

1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.

2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Non-deliberate Loading by Heavy Vehicles: Precast concrete, H-20 structural load rating.

3. Units in Sidewalk and Similar Applications with a Safety Factor for Non-deliberate Loading by Vehicles: Precast concrete H-20 structural load rating.

3.05 UNDERGROUND BOXES

Ground boxes shall be installed flush with finished grade with at least 6 inches of ¾ inch gravel at the base for drainage. In all cases lids shall be traffic rated and labeled as to the content of the box. Where larger boxes (i.e. 2'x3' or 3'x5') are required, spring-loaded lids shall be specified. Where the conduit enters the box, the PVC shall be flush with the finished surface of the box and fitted with a bell end. The conduit shall be mortared in place. The conduits shall be evenly spaced and in a straight line. All cable runs shall be securely attached to the wall via a cable rack.

3.06 EARTHWORK

b. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

c. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary top soiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

d. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 01 Section "Cutting and Patching."

1. A minimum compaction of 95% is required in paved areas, such as streets, parking lots or sidewalks. Higher compaction in all areas may be required by appropriate permits or inspectors. Compaction may be achieved utilizing mechanical means in 8-inch lifts. Compaction may also be accomplished by jetting with pressurized water. A concrete cap is required over sand backfilled conduits installed in landscaped areas or in areas where the depth of cover is less than 24 inches. The concrete cap is to cover the full width of the trench for the length of the applicable trench segment. The concrete cap shall be a minimum of 3 inches thick, have a minimum strength of 2500 pounds psi, and be red in color.

2. Coordinate installation of underground raceways with other outside and building construction work. Maintain existing outside utilities in operation.

3. Remove entirely and properly reinstall all raceway installations not in compliance with these requirements.

4. Provide a minimum cover of 24” over low voltage (communication - data fiber, coax and copper cabling) and 24 “over 600 voltage cables and 24” over wiring under 600 volts (Comply with NEC Table 300.5) underground raceways unless otherwise indicated.

5. Do not backfill underground direct burial and concrete-encased raceways until they have been inspected by the IOR, District or their representative.

6. Warning Tapes: Bury warning tapes approximately 18 inches above all underground conduit runs or duct banks. Align parallel to and within 12 inches of the centerline of runs.

7. Separation and Support

    a. Separate parallel runs of two or more raceways in a single trench with preformed, nonmetallic spacers designed for the purpose. Install spacers at intervals not greater than that specified in the NEC for support of the type of raceways used, and in no case greater than 10 feet.
    b. Support raceways installed in fill areas to prevent accidental bending until backfilling is complete. Tie raceways to supports, and raceways and supports to the ground, so that raceways will not be displaced when concrete encasement or earth backfill is placed.

8. Arrangement and Routing

    a. Arrange multiple conduits runs substantially in accordance with any details shown on the Drawings or as required due to field conditions. Locate underground conduits where indicated on the Drawings and graded to the required elevations. Make minor changes in location or cross-section as necessary to avoid obstructions or conflicts. Where raceway runs cannot be installed substantially as shown because of conditions not discoverable prior to digging of trenches, refer the condition to the Architect/District for instructions before further work is done.
    b. Slope duct banks downward, toward manholes, away from buildings, a minimum of 6” per 100’.
    c. Minimum 20’ bend radii for direction change
    d. Where other utility piping systems are encountered, maintain a 12-inch minimum vertical separation between raceways and other systems at crossings. Maintain a 12-inch minimum separation between raceways over couplings in other piping systems. Refer conflicts with these requirements to the Architect for instructions before further work is done.
    e. In multiple conduit runs, stagger raceway coupling locations so that couplings in adjacent raceways are not in the same transverse line.

2. Pull boxes and Handholes:

    a. Install vaults, pull boxes and hand-holes where shown on the drawings. Provide excavation, shoring, bracing, backfilling, grading, etc., in accordance with requirements specified elsewhere in these contract documents.
    b. Do not install vaults, pull boxes or hand-holes until final conduit grading, including field changes necessitated by underground interferences, has been determined. Set frames to final grades as required.
    c. Make installation so that raceways enter vault/pull boxes/ hand-holes at nearly right angles and as near as possible to one end of a wall, unless otherwise indicated.
    d. Install one ground rod in each vault and pull boxes. Connect all noncurrent-carrying metal parts in the manhole and any metallic raceway grounding bushings to this ground rod with No. 3/0 bare copper ground conductor and approved ground clamp and as required per NEC.

3. Preparation for Pulling in Conductors

    a. Do not install crushed or deformed raceways. Avoid traps in raceways. Take care to prevent the lodging of concrete, dirt, or trash in raceways, boxes, fittings, and equipment during the course of construction. Make raceways entirely free of obstructions or replace them. Ream all raceways, remove burrs, and clean raceway interior before introducing conductors or pull wires.
    b. Immediately after installation, plug or cap all raceway ends with water-tight and dust-tight seals until the time for pulling in conductors.
    c. For concrete-encased raceways, after the concrete envelope has set, pull a mandrel

of a diameter approximately 1/4 inch less than the raceway inside diameter, through each raceway. Then pull a bristle brush through each raceway to remove debris.

4. Empty Raceways:

a. Certain raceways will have no cabling pulled in as part of the Contract. Identify with tags at each end and at any intermediate pull point the origin and destination of each such empty raceway. Where a raceway has been identified with a name (number) in the Raceway Schedule, use that name on the tag in lieu of origin and destination. Provide a removable permanent cap over each end of each empty raceway. Provide a 3/8" nylon pull cord in each empty raceway.

B. Encased Ducts: Support ducts on duct separators:

a. Separator Installation:
Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

3.07 Concreting Sequence:

A. Pour each run of envelope between vaults/pull boxes or other terminations in one continuous operation.

3.08 1. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer’s written recommendations or use other specific measures to prevent expansion contraction damage.

2. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4- inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.

a. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

3. Reinforcement:
Reinforce concrete-encased duct banks where they cross disturbed earth and where

indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.

4. Forms:
Use walls of trench to form side walls of duct bank where soil is self -supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.

5. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 3 inches between ducts for like services, and 12 inches between power and signal ducts.

6. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles, (24 inches for concrete encased duct bank) unless otherwise indicated. Of importance are the parts that require the duct installer to:

•Secure duct separators to the earth and the ducts to prevent floating during concreting.
•Spade concrete during the pours.
•Not use power-driven agitating equipment unless specifically designed for duct - bank application. We found this sentence to be interesting and checked to see if any vibrators were specifically designed for duct bank application, but could find no references to such vibrators, or to power driven agitating equipment.

3.09 Warning Tapes: Comply with section 260553. Bury warning tape approximately 18 inches above all duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

1. Provide a 1” PVC conduit centered in the top of the duct bank containing a green– jacketed #12 AWG copper “tracer” wire where applicable.

3.10 As Built Conduit Drawings

a. At the completion of Contract, provide as-built conduit Drawings showing location and depth of all conduits. Measure conduit locations from permanently fixed readily discernable landmarks such as building corners, columns, manhole centerline, etc.
b. Pull boxes to be located in landscape areas.
c. Pull boxes shall be size larger than required to loop the cable in and out of the pull box without exceeding the minimum bend radii of the cable being installed.
d. Ducts should enter manholes on the short side.

3.11 EVALUATION or COMMISSIONING

1. List of items or systems requiring testing, evaluation, verification, or commissioning:

a. Required: Contact Project Manager to arrange inspection prior to pouring concrete and backfilling excavations.

2. Documentation required:

   a. Test reports: Concrete
   b. In-person witnessing: Prior to concrete pouring and excavation backfill.

3. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

4. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary top soiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

5. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 01 Section "Cutting and Patching."

3.12 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.

2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.

3. Test handhold grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.13 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

C. Cast Iron castings, covers, frames, manholes, vaults and pull boxes shall be cleaned and all

debris shall be removed prior to final acceptance.

END OF SECTION

SECTION 26 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water stop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. CALPICO, Inc.
c. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3. Pressure Plates: Carbon steel/Stainless steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating/ Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, water-stop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber water-stop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.

2.4 GROUT

A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
C. Design Mix: 5000-psi, 28-day compressive strength.
D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.
B. Comply with NEMA VE 2 for cable tray and cable penetrations.
C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall, so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel/cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position water-stop flange to be centered in concrete slab or wall.
C. Secure nailing flanges to concrete forms.
D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 26 05 50

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Raceways.
2. Building wire and connectors.
3. Supporting devices for electrical components.
4. Electrical identification.
5. Cutting and patching for electrical construction.

a. Touchup painting.

1.03 DEFINITIONS

A. GRS: Galvanized Rigid Steel conduit.

B. EMT: Electrical metallic tubing.

C. FMC: Flexible metal conduit.

D. IMC: Intermediate metal conduit.

E. LFMC: Liquid tight flexible metal conduit.

F. RNC: Rigid nonmetallic conduit.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer’s standard product data.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.06 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing equipment and devices requiring positioning prior to start of work.

C. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of

identification devices with completion of finished surface.

D. Where acoustical ceilings and similar finishes will conceal electrical identification markings and devices, coordinate installation of these items provided with the building.

PART 2 - PRODUCTS

2.01 RACEWAYS

A. EMT: ANSI C80.3, zinc-coated steel, with compression fittings.

B. FMC: Zinc-coated steel.

C. GRS: Galvanized Rigid Steel ANSI C80.6, zinc-coated steel, with threaded fittings.

D. LFMC: Zinc-coated steel with sunlight-resistant and mineral-oil-resistant plastic jacket.

E. RNC: NEMA TC 2, Schedule 40 PVC, with NEMA TC3 fittings.

F. Raceway Fittings: Specifically designed for the raceway type with which used compression type.

2.02 CONDUCTORS

A. Conductors, No. 10 AWG and Smaller: Solid or stranded copper 600V rated.

B. Conductors, Larger than No. 10 AWG: Stranded copper 600V rated.

C. Insulation: Thermoplastic, rated at 75 deg C minimum.

D. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.

2.03 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Metal Items for Use Outdoors or in Damp Locations: Hot dip galvanized steel.

C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- diameter slotted holes at a maximum of 2 inches o.c., in webs.

D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

E. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

F. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.

G. Expansion Anchors: Carbon-steel wedge or sleeve type.

H. Toggle Bolts: All-steel springhead type.

I. Powder-Driven Threaded Studs: Heat-treated steel.

2.04 ELECTRICAL IDENTIFICATION

A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Raceway and Cable Labels: Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and

minimum length of color field for each raceway and cable size.

1. Type: Pre-tensioned, wraparound plastic sleeves. Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the item it identifies.
2. Type: Preprinted, flexible, self-adhesive, vinyl. Legend is over laminated with a clear, weather- and chemical-resistant coating.
3. Color: Black letters on orange background.
4. Legend: Indicates voltage.

C. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick

D. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.

E. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch minimum thickness for signs up to 20 sq. in. and 1/8-inch minimum thickness for larger sizes. Engraved legend in black letters on white background.

F. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.

G. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing, with colors, legend, and size appropriate to the application. 1/4-inch grommets in corners for mounting.

H. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.05 TOUCHUP PAINT

A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.01 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria is not indicated, arrange and install components and equipment to provide the maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.02 RACEWAY APPLICATION

A. Use the following raceways for outdoor installations:

1. Exposed: GRS/IMC.
2. Concealed: GRS/IMC.
3. Underground, Single Run: RNC. Schedule 40
4. Underground Grouped: RNC. Schedule 40

5. Boxes and Enclosures: NEMA 250, Type 3R or NEMA Type 1 as specified on drawings.

B. Use the following raceways for indoor installations:

1. Exposed: EMT.
2. Concealed: EMT.
3. Damp or Wet Locations: GRS.
4. Boxes and Enclosures: NEMA 250, Type 1 or 3R as indicated.

3.03 RACEWAY AND CABLE INSTALLATION

A. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors. All exterior exposed conduits shall be GRS type with threaded fittings and Interior spaces shall be EMT type with compression type fittings.

B. Install raceways and cables at least 6 inches away from parallel runs of water pipes. Locate horizontal raceway runs above water piping.

C. Use temporary raceway caps to prevent foreign matter from entering.

D. Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

E. Use raceway and cable fittings compatible with raceways and cables and suitable for use and location.

F. Transition from nonmetallic tubing to rigid steel conduit before rising above floor/ground.

1. Make bends in exposed parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for exposed parallel raceways. All riser conduits shall be taped with 2 Layers of PVC pipe wrap (2 layers of 10 Mil thickness) to prevent corrosion and puncture resistance.

G. Install pull wires in empty raceways. Use No. 12 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 24 inches of slack at each end of the pull wire.

3.04 WIRING METHODS FOR POWER, LIGHTING, AND CONTROL CIRCUITS

A. Feeders: Type THHN/THWN insulated copper conductors in raceway.

B. Branch Circuits: Type THHN/THWN insulated copper conductors in raceway.

3.05 WIRING INSTALLATION

A. Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un spliced conductors.

B. Install wiring at outlets with at least 12 inches of slack conductor at each outlet.

C. Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals, according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

D. Lighting Whips

1. The use of MC cable is permitted for lighting installations. The length of the whip shall not exceed 6 feet.

3.06 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.

B. Dry Locations: Steel materials.

C. Support Clamps for PVC Raceways: Click-type clamp system.

D. Selection of Supports: Comply with manufacturers written instructions.

E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

3.07 SUPPORT INSTALLATION

A. Install support devices to fasten and support electrical components securely and permanently.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations, so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

F. Install 1/4-inch diameter or larger threaded steel hanger rods, unless otherwise indicated.

G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

I. Simultaneously install vertical conductor supports with conductors.

J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.

K. Install metal channel racks for mounting cabinets, panel boards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:

1. Wood: Fasten with wood screws or screw-type nails.
2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
3. New Concrete: Concrete inserts with machine screws and bolts.
4. Existing Concrete: Expansion bolts.
5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
6. Steel: Welded threaded studs or spring-tension clamps on steel.
7. Field Welding: Comply with AWS D1.1.

8. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
9. Light Steel: Sheet-metal screws.
10. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.08 IDENTIFICATION MATERIALS AND DEVICES

A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

C. Self-Adhesive Identification Products: Clean surfaces before applying.

D. Identify raceways and cables with color banding as follows:

1. Bands: Pre-tensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
3. Colors: As follows:

b. Telecommunication System: Green and yellow.

E. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

F. Install continuous underground plastic markers during trench backfilling, for exterior underground communication lines located directly above power and communication lines. Locate 6 inches below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches overall, use a single line marker.

G. Color-code 208/120-Volt & 277/480-volt system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:

1. Phase A: Black.
2. Phase B: Red.
3. Phase C: Blue.

H. 277/480 Volt

- Brown - phase 1
- Orange - phase 2
- Yellow - phase 3
- Gray or with 2 white stripes -Neutral
- Green with yellow stripe - ground

I. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for

outdoor items.

J. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch-high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

3.09 FIRESTOPPING

A. Apply fire stopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Fire stopping materials and installation requirements are as required by UL.

3.10 DEMOLITION

A. Protect existing electrical equipment and installations to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

D. Remove demolished material from Project site.

E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.11 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing fire stopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.12 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including the following:

1. Raceways.
2. Building wire and connectors.
3. Supporting devices for electrical components.
4. Electrical identification.
5. Electrical demolition.
6. Cutting and patching for electrical construction.
7. Touchup painting.

3.13 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by

manufacturer.

3.14 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Nameplates and labels.
2. Identification for raceways.
3. Identification of power and control cables.
4. Identification for conductors.
5. Underground-line warning tape.
6. Warning labels and signs.
7. Instruction signs.
8. Equipment identification labels, including arc-flash warning labels.
9. Panel Board Directories.
10. Engraved Device cover plates
11. Miscellaneous identification products.

1.02 APPLICABLE PUBLICATIONS

The following publications form a part of this specification. The publications are referred to in the text by the basic designation only.

A. American National Standards Institute, Inc. (ANSI) Publications:

1. Latest Edition of National Electrical Safety Code with 2022 California Electrical Code (CEC) amendments.

2. Z35.1 Accident Prevention Signs

B. State of California Administrative Code:

1. Title 8, Industrial Relations

C. National Fire Protection Association (NFPA) Publication:

1. 70-2020National Electrical Code (NEC) with 2022 CEC Amendments

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Delegated-Design Submittal: For arc-flash hazard study.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

PART 2 - PRODUCTS

2.01 MEDIUM VOLTAGE

A. Comply with CAL OSHA Regulation Standards –.

2.02 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1and IEEE C2. for minimum size of letters for legend and for minimum length

B. of color field for each raceway size.

C. Comply with 2022 CEC .

D. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

E. Comply with ANSI Z535.4 for safety signs and labels.

F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

2.03 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.

2. Legend: Indicate voltage and system or service type.

B. Warning labels and signs shall include, but are not limited to, the following legends:

1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES

2. Identify source of power with location.

3. Provide warning signs or labels for arc flash, and voltages, and others.

2.04 NAMEPLATES

A. Provide laminated plastic nameplates for all electrical equipment and devices including, but not limited to, the following:

1. Enclosures for all separately enclosed devices including but not limited to disconnect switches, circuit breakers, contactors, time switches, control stations and relays.

2. Wall switches not within sight of outlet controlled.

3. Special systems such as but not limited to telephone, warning, and signal systems. Identification shall be at each equipment rack, terminal cabinet, control panel, annunciator, and pull box.

4. Devices mounted within and part of an equipment including circuit breakers, switches, control devices, control transformers, relays, indication devices and instruments.

5. Receptacles and lighting switches: Panelboard I.D. and circuit number. These shall be provided with P- Touch or Vinyl labelling.

6. All Fire Alarm equipment, devices and cabling shall be identified at each location including wiring terminal cabinets, device locations, pull and junction boxes.

B. Nameplate designations shall clearly state:

1. Provide number, location, and letter designation of nameplates as indicated.

2. Manufacturer's nameplate including equipment design rating of current, voltage, KVA, HP, bus bracing rating, or as applicable.

3. Equipment nameplate designating system usage and purpose, system nominal voltage, equipment rating for KVA, amperes, HP and RPM as applicable.

4. Contactors: Voltage, continuous current, horsepower or interrupting current, and whether "mechanically held" or "electrically held".

5. Motors: Rated voltage, full load amperes, frequency, phases, speed, horsepower, code letter rating, time rating, type of winding, class, and temperature.

6. Controllers: Voltage, current, horsepower, and trip setting of motor running overcurrent protection.

7. Receptacles and lighting switches (wiring devices): Panel designation and circuit number. These shall be provided with P- Touch or Vinyl labelling.

C. Nameplates shall be melamine plastic, 0.125-inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering into the black core. Minimum size of nameplates shall be 1 Inch by 2.5 inches. Lettering shall be normal block style unless otherwise noted.

D. Letter Size:

1. Use 0.25-inch letters for identifying individual equipment and loads.

2. Use 0.50 inch for identifying grouped equipment and loads.

2.05 WIRE MARKERS

A. Description: Tape or tubing type wire markers, 3M Scotch Code or approved equal. Provide markers for each conductor (power and communication systems) at panel board gutters, pull boxes, junction boxes, outlet boxes, and each load connection, MDF, IDF, manholes/vaults/pull boxes.

B. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.

2. Communication and Signal wiring: Provide wire markers for cables identifying origin and end termination at all equipment, MDF/IDF/Vaults/Pull Boxes etc.

3. Control Circuits: Control wire number indicated on schematic or interconnection diagrams on shop drawings.

2.06 LABELS

A. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Champion America.
c. emedco.
d. LEM Products Inc.
e. Panduit Corp.

B. Self-Adhesive Labels:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. emedco.
c. Ideal Industries, Inc.
d. LEM Products Inc.
e. Panduit Corp.

2. Preprinted, 3-mil- thick, polyester/vinyl flexible label with acrylic pressure-sensitive adhesive.

3. Polyester/Vinyl, thermal, transfer-printed, 3-mil- thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

a. Nominal Size: 3.5-by-5-inch.

2.07 TAPES AND STENCILS:

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carlton Industries, LP.
b. Champion America.
c. Ideal Industries, Inc.
d. Panduit Corp.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. Emedco.

C. Floor Marking Tape: 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carlton Industries, LP.
b. Seton Identification Products.

D. Underground-Line Warning Tape

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Ideal Industries, Inc.
c. LEM Products Inc.
d. Marking Services, Inc.
e. Seton Identification Products.

2. Tape:

    a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
    b. Printing on tape shall be permanent and shall not be damaged by burial operations.
    c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

3. Color and Printing:

    a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
    b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
    c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, , COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".

4. Tag: Type I:

    a. Pigmented polyolefin, bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
    b. Width: 3 inches.
    c. Thickness: 4 mils. Weight: 18.5 lb/1000 sq. ft..
    d. Tensile according to ASTM D 882: 30 lbf and 2500 psi.

5. Tag: Type ID:

    a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
    b. Width: 3 inches.
    c. Overall Thickness: 5 mils.
    d. Foil Core Thickness: 0.35 mil.
    e. Weight: 28 lb/1000 sq. ft.
    f. Tensile according to ASTM D 882: 70 lbf and 4600 psi.

6. Tag: Type IID:

    a. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
    b. Width: 3 inches
    c. Overall Thickness: 8 mils.
    d. Foil Core Thickness: 0.35 mil
    e. Weight: 34 lb/1000 sq. ft.
    f. Tensile according to ASTM D 882: 300 lbf and 12,500 psi.

2.08 Tags

A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

    1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        a. Brady Corporation.
        b. Carlton Industries, LP.
        c. Emedco.
        d. Seton Identification Products.

B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.023 inch thick, color-coded for phase and voltage level, with factory screened permanent designations; punched for use with self-locking cable tie fastener.

    1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        a. Brady Corporation.
        b. Carlton Industries, LP.
        c. Emedco.
        d. LEM Products Inc.
        e. Panduit Corp.

C. Write-On Tags:

    1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        a. Carlton Industries, LP.

b. LEM Products Inc.
c. Seton Identification Products.

2. Polyester Tags: 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to raceway, conductor, or cable.

3. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

4. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.09 Signs

A. Baked-Enamel Signs:

1. Preprinted aluminum signs punched or drilled for fasteners, with colors, legend, and size required for application.

2. 1/4-inch grommets in corners for mounting.

3. Nominal Size: 7 by 10 inches.

4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carlton Industries, LP.
b. Champion America.
c. Emedco.

B. Metal-Backed Butyrate Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing and with colors, legend, and size required for application.

2. 1/4-inch grommets in corners for mounting.

3. Nominal Size: 10 by 14 inches.

4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Champion America.
c. Emedco.

C. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.

2. Thickness:

a. For signs up to 20 sq. inches, minimum 1/16-inch-.
b. For signs larger than 20 sq. inches, 1/8 inch thick.

c. Engraved legend with black letters on white face.

d. Punched or drilled for mechanical fasteners.
e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. Emedco.

2.10 CABLE TIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ideal Industries, Inc.

2. Marking Services, Inc.

3. Panduit Corp.

B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch

2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi

3. Temperature Range: Minus 40 to plus 185 deg F.

4. Color: Black, except where used for color-coding.

C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.

2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.

3. Temperature Range: Minus 40 to plus 185 deg F

4. Color: Black.

D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, self-locking.

1. Minimum Width: 3/16 inch.

2. Tensile Strength at 73 deg F according to ASTM D 638: 7000 psi.

3. UL 94 Flame Rating: 94V-0.

4. Temperature Range: Minus 50 to plus 284 deg F

5. Color: Black.

2.8 UNDERGROUND LINE WARNING TAPE

A. Tape:

1.Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.

2. Printing on tape shall be permanent and shall not be damaged by burial operations.

3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

E. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

A. Install nameplate parallel to equipment lines. Fasten nameplates to enclosures with a minimum of two sheet-metal screws or two rivets. Fasten nameplates to device plates with suitable adhesive. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

B. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

F. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.

2. In Spaces Handling Environmental Air: Plenum rated.

G. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

3.03 IDENTIFICATION SCHEDULE

A. Accessible Raceways, 600 V or Less, for Service, Feeder, and Branch Circuits, more 120 V to Ground: Identify with self-adhesive vinyl tape applied in bands. Install labels at 10-foot maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels containing the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."

2. "POWER."

3. "UPS."

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and hand holes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase- and Voltage-Level identification, 600 V or Less: Use industry standard colors for ungrounded service feeders and branch-circuit conductors.

a. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

D. Nameplate Installation:

1. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
2. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
3. Secure nameplate to equipment as recommended by the manufacturer.
4. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
5. Install nameplates for the following with source, end destination, feeder #, voltage, ampacity, feeder wire size for all medium & low voltage (600 volts & below) equipment, Locate equipment labels where accessible and visible:
   a. Switchboards.
   b. Panelboards & Distribution boards.
   c. Transformers.
   d. Service Disconnects.
   f. Motor Control Devices
   g. Manual Fusible Switches
   h. All other equipment installed as part of this project.

E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive, self-laminating polyester labels/self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.

F. Control-Circuit Conductor Termination Identification: For identification at terminations, provide

self-adhesive, self-laminating polyester labels/self-adhesive vinyl labels with the conductor designation.

G. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of marker-tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

I. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.

2. Install underground-line warning tape for direct-buried cables and cables in raceways.

J. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

K. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.

2. Identify system voltage with black letters on an orange background.

3. Apply to exterior of door, cover, or other access.

4. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

a. Power-transfer switches.
b. Controls with external control power connections.

L. Arc Flash Warning Labeling: Self-adhesive thermal transfer vinyl labels.

1. Comply with NFPA 70E and ANSI Z535.4.

2. Comply with Section 260574.19 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.

M. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

N. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for emergency operations.

O. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.

1. Labeling Instructions:

a. Indoor Equipment: Engraved, laminated acrylic or melamine plastic label, punched or drilled for mechanical fasteners. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label 4 inches high.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
d. Unless labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Receptacles and lighting switches (wiring devices): Panel designation and circuit number. These shall be provided with P- Touch or Vinyl labelling.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Lighting and appliance branch-circuit panel boards.

1.02 DEFINITIONS

A. MCCB: Molded-case circuit breaker.

1.03 REFERENCES

The panelboard(s) and circuit breaker(s) referenced herein are designed and manufactured according to the latest revision of the following specifications.

A. NEMA PB 1 - Panelboards
B. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
C. NEMA AB 1 - Molded Case Circuit Breakers
D. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
E. UL 50 - Enclosures for Electrical Equipment
F. UL 67 - Panelboards
G. UL 98 - Enclosed and Dead-front Switches
H. UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures
I. CSA Standard C22.2 No. 29-M1989 - Panelboards and Enclosed Panelboards
J. CSA Standard C22.2 No. 5-M91 - Molded Case Circuit Breakers
K. Federal Specification W-P-115C - Type I Class 1
L. Federal Specification W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit And Service.
M. NFPA 70 - National Electrical Code (NEC)
N. ASTM - American Society of Testing Materials
O. IBC – International Building Code – Seismic compliance requirements

P. NFPA 5000 – NFPA Building Code – Seismic compliance requirements.
Q. ASCE 7 – American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures – Seismic compliance requirements
R. ICC ES AC156 – International Code Council Evaluation Services Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems – seismic testing protocol.
S. Manufacturer's Instruction Bulletin and installation Manual

1.04 ACTION SUBMITTALS

A. Product Data: For each type of panel board.

B. Shop Drawings: For each panel board and related equipment.

1. Include dimensioned plans, elevations, sections, and details.

2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.

3. Detail bus configuration, current, and voltage ratings.

4. Short-circuit current rating of panel boards and overcurrent protective devices.

5. Include evidence of NRTL listing for series rating of installed devices.

6. Include evidence of NRTL listing for SPD as installed in panel board.

7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

8. Include wiring diagrams for power, signal, and control wiring.

9. Key interlock scheme drawing and sequence of operations.

10. Include time-current coordination curves for each type and rating of overcurrent protective device included in panel boards.

1.05 INFORMATIONAL SUBMITTALS

A. Panel board schedules for installation in panel boards.

1.06 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.07 FIELD CONDITIONS

A. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures not exceeding 104º F.

2. Altitude not exceeding 3300 feet.

1.08 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panel boards that fail in materials or workmanship within specified warranty period.

1. Manufacturer shall warrant specified equipment to be free from defects in materials and workmanship for twelve (12) months of service not to exceed eighteen (18) months from the date of shipment.

PART 2 - PRODUCTS

2.01 PANELBOARDS COMMON REQUIREMENTS

A. Fabricate and test panel boards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

E. Enclosures: Flush and Surface - mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.

b. Outdoor Locations: NEMA 250, Type 3R.
c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Height: 84 inches maximum with operating device height of 6’7” maximum.

3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.

4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.

F. Incoming Mains Location: Convertible between top and bottom.

G. Phase, Neutral, and Ground Buses Hard-drawn copper, 98 percent conductivity.

H. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: =Hard-drawn copper, 98 percent conductivity.

2. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panel board.

3. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panel board.

4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

5. Sub feed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

I. NRTL Label: Panel boards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panel boards shall have meter enclosures, wiring, connections, and other provisions for digital metering. Coordinate with utility company for exact requirements.

J. Future Devices: Panel boards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

K. Panel board Short-Circuit Current Rating: Series and Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

2.02 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panel boards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

B. Surge Suppression: Factory installed as an integral part of indicated panel boards, complying with UL 1449 SPD Type 1/Type 2 as indicated on the drawings.

2.03 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are limited to the following:

1. Square D; by Schneider Electric. NF & NQOD Type or approved equal.

a. Interior

1) Shall be type NQ or NQOD panelboard rated for 240 Vac/48 Vdc maximum.

Continuous main current ratings, as indicated on associated schedules on drawings, not to exceed 600 amperes maximum.

2) Shall be type NF panelboard for 480Y/277 Vac maximum. Continuous main current ratings, as indicated on associated schedules on drawings, not to exceed 600 amperes for main breaker panelboards and not to exceed 800 amperes for main lug panelboards.
3) Minimum short circuit current rating: As indicated on the drawings and obtained from shirt circuit & coordination studies in rms symmetrical amperes at 240 Vac.& 600 Vac
4) Provide one (1) continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors suitable for plug-on or bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing shall be plated copper as standard construction. Bus bar plating shall run the entire length of the bus bar. Panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and NEC Articles 230-F and -G.
5) All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.
6) A solidly bonded copper equipment ground bar shall be provided.
7) Split solid neutral shall be plated and located in the mains compartment up to 225 amperes so all incoming neutral cable may be of the same length.
8) Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have filler plates covering unused mounting spaces.
9) Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL Listed label and short circuit current rating shall be displayed on the interior or in a booklet format.
10) Interiors shall be field convertible for top or bottom incoming feed. Main circuit breakers in 100A interiors shall be horizontally/vertically] mounted. Main circuit breakers over 100A shall be vertically mounted. Sub-feed circuit breakers shall be vertically mounted. Main lug interiors up to 400 amperes shall be field convertible to main breaker. Interior leveling provisions shall be provided for flush mounted applications.
11) Interior phase bus shall be pre-drilled to accommodate field installable options (NQ only), i.e., Sub-Feed Lugs, Sub-Feed Breakers, Thru-Feed Lugs.

2. Main Circuit Breaker:

a. Shall be Square D type circuit breakers.
b. Main circuit breakers shall have an over center, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Each thermal element shall be true rms sensing and be factory calibrated to operate in a 40° C ambient environment. Thermal elements shall be ambient compensating above 40° C.
c. Two- and three-pole circuit breakers shall have common tripping of all poles. Circuit breaker frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker that allows the user to simultaneously select

the desired trip level of all poles. Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.

d. Breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be UL Listed for reverse connection without restrictive line or load markings.
e. Circuit breaker escutcheon shall have international I/O markings, in addition to standard ON/OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the ON or OFF position.
f. Lugs shall be CSA and UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating per NEC Table 310-16. Lug body shall be bolted in place; snap-in designs are not acceptable.
g. The circuit breakers shall be CSA and UL Listed for use with the following accessories: Shunt Trip, Under Voltage Trip, Ground Fault Shunt Trip, Auxiliary Switch, Alarm Switch, Mechanical Lug Kits, and Compression Lug Kits.

3. Branch Circuit Breakers

a. Shall be Square D type circuit breakers. Circuit breakers shall be UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the associated schedules on drawings.
b. Molded case branch circuit breakers shall have bolt-on type bus connectors.
c. Circuit breakers shall have an over center toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two- and three-pole circuit breakers shall have common tripping of all poles.
d. There shall be two forms of visible trip indication. The breaker handle shall reside in a position between ON and OFF. In addition, there shall be a red VISI-TRIP® indicator appearing in the clear window of the circuit breaker housing.
e. The exposed faceplates of all branch circuit breakers shall be flush with one another.
f. Lugs shall be UL Listed to accept solid or stranded copper conductors only. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating per NEC Table 310-16. Branch circuit breakers rated 30 amperes and below shall be UL Listed to accept 60° C rated wire.
g. Breakers shall be UL Listed for use with the following factory installed accessories: Shunt Trip, Auxiliary Switch, and Alarm Switch.

4. Enclosures

a. Type 1 Boxes

1) Boxes shall be hot zinc dipped galvanized steel constructed in accordance with UL 50 requirements. Unpainted galvannealed steel is not acceptable.
2) Boxes shall have removable end walls with knockouts located on one end. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.
3) Box width shall be 20” wide maximum.

b. Type 1 Fronts

1) Front shall meet strength and rigidity requirements per UL 50 standards. Front shall have ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
2) Fronts shall be hinged 1-piece with door. Mounting shall be flush/surface as indicated on associated schedules and drawings.
3) Panelboards shall have MONO-FLAT fronts with concealed door hinges and mounted with trim screws. Front shall not be removable with the door locked. Doors on front shall have rounded corners and edges shall be free of burrs.
4) Front shall have cylindrical tumbler type lock with catch and spring-loaded stainless-steel door pull. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory cardholder shall be mounted on the inside of door.

c. **Type 3R**

1) Enclosures shall be constructed in accordance with UL 50 requirements. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
2) All doors shall be gasketed and equipped with a tumbler type vault lock and two (2) additional quarter turn fasteners on enclosures 59 inches or more in height. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory cardholder shall be mounted on the inside of door.
3) Maximum enclosure dimensions shall not exceed 21” wide and 6.5” deep.

2.04 IDENTIFICATION

A. Panel board Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panel board door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panel board door, mounted in metal frame with transparent protective cover.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1.

B. Install panel boards and accessories according to NECA 407/NEMA PB 1.1.

C. Mount top of trim 90 inches above finished floor unless otherwise indicated.

D. Mount panel board cabinet plumb and rigid without distortion of box.

E. Mount recessed panel boards with fronts uniformly flush with wall finish and mating with back box.

F. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

G. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

H. Install filler plates in unused spaces.

I. Stub four 1-inch empty conduits from panel board into accessible ceiling space or space designated to be ceiling space in the future. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

J. Wiring shall be done in an orderly fashion with crisp lines and good connections, torqued to

the manufacturer’s required ratings.

3.02 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements per standard codes.

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panel board door.

C. Panel board Nameplates: Label each panel board with a nameplate complying with requirements for identification.

D. Device Nameplates: Label each branch circuit device in power panel boards with a nameplate complying with requirements for identification.

E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.03 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panel board bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panel boards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panel boards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

SECTION 262726

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Standard-grade receptacles, 120 V, 20 A.
2. GFCI receptacles, 120 V, 20 A.
3. Toggle switches, 120/277 V,20 A.
4. Occupancy sensors.
5. Wall-box dimmers.
6. Wall plates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates with labels as specified in Section26 05 53.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 Manufacturers: Subject to compliance with requirements, provide products by the following:

A. Receptacles, spec grade, Decora Style, 20A rated:
1. Leviton
2. Pass & Seymour
3. Hubbell

B. Switches, Decora style 20A rated, spec grade (District Standard):
1. Leviton
2. Pass & Seymour
3. Hubbell

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Comply with NFPA 70.

C. RoHS compliant.

D. Comply with NEMA WD 1.

E. Device Color:

1. Wiring Devices Connected to Normal Power System: **White** or **as selected by Architect** unless otherwise indicated or required by NFPA 70 or device listing.

F. Wall Plate: All cover plates for receptacles and switches shall be 302 Stainless steel.

2.3 STANDARD-GRADE RECEPTACLES, 120 V, 20 A (All devices shall be Decora Style with matching stainless-steel covers).

A. Duplex Receptacles, 120 V, 20 A:
   1. Description: Two pole, three wire, and self-grounding.
   2. Configuration: NEMA WD 6, Configuration 5-20R.
   3. Standards: Comply with UL 498 and FS W-C-596.

B. Tamper-Resistant Duplex Receptacles, 120 V, 20 A:
   1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
   2. Configuration: NEMA WD 6, Configuration 5-20R.
   3. Standards: Comply with UL 498 and FS W-C-596.
   4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

C. Weather-Resistant Duplex Receptacle, 120 V, 20 A:
   1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
   2. Configuration: NEMA WD 6, Configuration 5-20R.
   3. Standards: Comply with UL 498.
   4. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

D. Tamper- and Weather-Resistant Duplex Receptacles, 120 V, 20 A:
   1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
   2. Configuration: NEMA WD 6, Configuration 5-20R.
   3. Standards: Comply with UL 498.
   4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.4 GFCI RECEPTACLES, 120 V, 20 A (All devices shall be Decora Style with matching stainless-steel covers).

A. Duplex GFCI Receptacles, 120 V, 20 A:
   1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
   2. Configuration: NEMA WD 6, Configuration 5-20R.
   3. Type: **Feed** through.
   4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

2.5 Tamper-Resistant Duplex GFCI Receptacles, 120 V, 20 A: (All devices shall be Decora Style with matching stainless-steel covers).

   1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
   2. Configuration: NEMA WD 6, Configuration 5-20R.
   3. Type: **Feed** through.
   4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
   5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

2.6 Tamper- and Weather-Resistant, GFCI Duplex Receptacles, 120 V, 20 A: (All devices shall be Decora Style with matching stainless-steel covers).
   1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
   2. Configuration: NEMA WD 6, Configuration 5-15R.
   3. Type: **feed** through.
   4. Standards: Comply with UL 498 and UL 943 Class A.
   5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.7 DECORA STYLE SWITCHES, 120/277 V, 20 A

A. Single-Pole Switches, 120/277 V, 20 A:
   1. Standards: Comply with UL 20 and FS W-S-896.

B. Two-Pole Switches, 120/277 V, 20 A:
   1. Comply with UL 20 and FS W-S-896.

C. Three-Way Switches, 120/277 V, 20 A:
   1. Comply with UL 20 and FS W-S-896.

D. Lighted Single-Pole Switches, 120/277 V, 20 A:
   1. Description: Handle illuminated when switch is [**on**] [**off**].
   2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

2.8 DECORATOR-STYLE DEVICES, 20 A

A. Decorator Duplex Receptacles, 120 V, 20 A:

   1. Description: Two pole, three wire, and self-grounding. Square face.
   2. Configuration: NEMA WD 6, Configuration 5-20R.
   3. Standards: Comply with UL 498.

B. Decorator Tamper-Resistant Duplex Receptacles, 120 V, 20 A :

   1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
   2. Configuration: NEMA WD 6, Configuration 5-20R.
   3. Standards: Comply with UL 498.
   4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

C. Decorator, Tamper- and Weather-Resistant, Duplex Receptacles, 120 V, 20 A :

   1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
   2. Configuration: NEMA WD 6, Configuration 5-20R.
   3. Standards: Comply with UL 498.
   4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

D. Decorator Single-Pole Switches, 120/277 V, 20 A :

   1. Comply with UL 20.

E. Decorator Single-Pole Lighted Switches,120/277 V, 20 A :

   1. Description: Square face illuminated when circuit is switched off.

2. Standards: Comply with UL 20.

2.9 OCCUPANCY SENSORS

A. Wall Switch Sensor Light Switch, Dual Technology.

1. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual (ultrasonic and passive infrared) technology.
2. Standards: Comply with UL 20.
3. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
4. Adjustable time delay of **5 to 30** minutes.
5. Able to be locked to **Automatic** and **Manual**-On mode.
6. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc

2.10 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- thick, satin-finished, Type 302 stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover and listed and labeled for use in wet and damp locations.

C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
2. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
3. Install wiring devices after all wall preparation, including painting, is complete.

C. Device Installation:

1. Connect devices to branch circuits using pigtails that are not less than 12 inches in length.
2. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

D. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles **down**, and on horizontally mounted receptacles to the **right**.

E. Device Plates:
1. Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
2. Each device and switch plate shall have a printed labeled with the panel name and circuit number, see section the Electrical Identification specification for additional information.

F. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi gang wall plates.

G. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 FIELD QUALITY CONTROL

A. Tests for Receptacles:

1. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
2. Using the test plug, verify that the device and its outlet box are securely mounted.

B. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION

SECTION 26 96 00. D

TESTING REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Test procedures specified in this Section are in addition to that specified in other Sections of Division 26.

B. Provide the services of a recognized independent testing firm to perform testing work, including but not limited to:

1. Panelboards.
2. Grounding system.
3. Circuit breakers 100 amperes and larger.

1.02 REFERENCES

A. Perform inspections and tests in accordance with the following codes and standards:

1. National Electrical Manufacturer's Association - NEMA.
2. American Society for Testing and Materials- ASTM.
3. Institute of Electrical and Electronic Engineers- IEEE.
4. International Electrical Testing Association- NETA Acceptance Testing Specifications- ATS-1991
5. American National Standards Institute -ANSI.
6. State and local codes and ordinances.
7. Insulated Cable Engineers Association - ICEA.
8. Occupational Safety and Health Administration - OSHA.
9. ANSI/NFPA 70: National Electrical Code.
10. ANSI/NFPA 70B: Electrical Equipment Maintenance.
11. NFPA 70E: Electrical Safety Requirements for Employee Workplaces.
12. ANSI/NFPA 78: Lightning Protection Code.
13. ANSI/NFPA 101: Life Safety Code.
14. NFPA 72

B. Division 26 specification sections and drawings are interrelated. Use Division 26, in its entirety, and accompanying electrical drawings for interpreting inspection and testing requirements.

C. Use Manufacturer's instruction manuals applicable to each particular equipment/device for special inspection and testing requirements.

1.03 SUBMITTALS

A. Comply with provisions of Division 01 -: SUBMITTAL PROCEDURES.

B. Provide the following certified test report information, including but not limited to:

1. Summary of job.
2. Description of equipment tested.
3. Description of test procedure.
4. List of test equipment and calibration date.
5. Test results.
6. Conclusions and recommendations.
7. Appendix, including all field test reports.

C. Provide report certification by a licensed contractor technician.

D. Secure report and test documents together using index tabs and a 3-ring binder.

E. Provide brief field report after completion of any test prior to leaving the site. Report may be typed or printed. List the equipment tested, describe any deficiencies found and recommended corrections. Leave report copies with the Inspector of Record (I.O.R) and General Contractor.

1.04 TESTING AGENCY QUALIFICATIONS

A. Member of the International Electrical Testing Association, specializing in the testing of equipment or apparatus specified in this Section with minimum 5 years' experience and employed by contractor.

1.05 DIVISION OF RESPONSIBILITY

A. Routine work performed by the Contractor prior to and in addition to tests performed by the testing firm:

1. Cleaning of equipment and apparatus.
2. Insulation-resistance and continuity test.
3. Rotation test.
4. Equipment bolt torquing.
5. Inspect for physical damage.
6. Proper equipment connection and operation.
7. Coordinate exact motor overload requirements.

B. The Contractor has the option to assign all or any portion of above listed routine work to the testing firm at his own expense. All testing equipment, cabling and grounding system must be performed by a certified technician.

C. The Contractor provides suitable and stable source of electrical power to each test site as required for the testing.

D. The Contractor notifies the Inspector of Record (I.O.R) and the testing technician when equipment becomes available for acceptance tests. Work coordinated to expedite project scheduling.

E. The Contractor is responsible for providing a Over Current Protective Device and Arc Flash Study (along with equipment submittals) prepared and certified by an independent testing or engineering firm or manufacturer of the equipment as outlined by Sections 26 0573.19.

F. The testing firm notifies the District's representative prior to commencement of any testing.

G. Report any system, material, or workmanship which is found defective on the basis of acceptance tests to the Owner's representative in writing.

H. The testing technician maintains a written record of all tests and, upon completion of project, assembles and certifies final test report.

I. Safety and Precautions:

1. Safety practices include, but are not limited to, the following requirements:

a. Occupation Safety and Health Act.
b. Accident Prevention Manual for Industrial Operations, National Safety Council.
c. Applicable state and local safety operating procedures.
d. Owner's safety practices.
e. National Fire Protection Association- NFPA 70E.
f. American National Standards for Personnel Protection.

2. Testing performed with apparatus de-energized. Exceptions must be thoroughly reviewed to identify safety hazards and devise adequate safeguards.

3. The testing technician provides a designated safety representative on the project to supervise the testing operations with respect to safety.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A. The testing technician provides all test equipment.

B. Care and Precautions:

1. Contractor responsible for any damage to equipment or material due to improper test procedures or test apparatus handling. Replace or restore to original condition any damaged equipment or material.

2. Provide and use safety devices such as rubber gloves and blankets, protective screen,

barriers and danger signs to adequately protect and warn all personnel in the vicinity of the tests. Use test equipment that is calibrated and certified traceable to the National Bureau of Standards. Certification date: No later than 6 months.

PART 3 - EXECUTION

3.01 APPLICATION

A. General:

1. Provide all materials, supplies, tools, equipment, labor, and services required to perform all tests as specified in this Section.

2. Correct all deficiencies revealed by tests. Replace at contractor's cost, all materials and equipment found faulty.

3. The testing intent is to assure that all electrical equipment, both contractor and District supplied, is operational within industry and manufacturer's tolerances and is installed in accordance with design specifications.

4. The test and inspections determine the suitability for energization.

5. Use the Inter National Electrical Testing Association (NETA) guidelines for all testing procedure and acceptance test values of results.

6. Complete all test prior to commissioning and final acceptance.

B. Summary:

1. Test all cable, equipment and systems listed above to assure proper installation, setting, connections, and functioning in accordance with the Drawings, Specifications, and the manufacturer's recommendations. It is the intent that field testing be extensive, and complete as specified, to provide positive assurance of totally correct installation and operation of equipment.

2. Furnish all necessary test equipment to satisfactorily perform all tests specified herein.

3. When conducting tests, comply with the following:

   a. Notify the Owner and I.O.R at least 2 weeks prior to commencement of any testing.
   b. Conduct all tests in the presence of the Owner's Representative and I.O.R except when advised that his presence will not be necessary.
   c. Include all tests and inspections recommended by the equipment manufacturer whether required by these Specifications or not, unless specifically waived by the owner.
   d. Maintain a written record of all tests showing date, personnel making test, equipment or material tested, tests performed, manufacturer and serial number of testing equipment and results.

4. Tests include, but are not limited to, the following:

   a. All Wiring: Free of shorts unintentional and grounds.
   b. Power Circuit Breakers: Calibration to time/current curves, physical condition, contact resistance, insulation resistance.
   c. Grounding system: Ground resistance (impedance), ground integrity.
   d. Secondary Service Bus Ducts: Proper torque on connections, insulation resistance, physical condition.
   e. Motor Controls: Proper overload heater sizes.
   f. Ground Fault System: Neutral free of improper grounds and pick-up.
   g. Protective Relays: Pick-up, timing, insulation resistance, physical condition.
   h. Switchboards, Panelboards, and similar circuit breaker equipment: Insulation resistance, physical condition.
   i. Feeder Cables: Insulation resistance.
   j. Motors: proper rotation, insulation resistance.
   k. Trip setting, adjustments and testing of all electronic breakers as selective coordination test reports based on the coordination study described in Section 26 05 73

C. Minimum Acceptable Test Results:

1. Ground System: The main ground electrode system resistance to ground no greater than 5 ohms and as permitted in C.E.C. Article 250.

2. Electrical Apparatus and System Insulation Resistance:

   a. Rating of Equipment of 250 volts maximum: Use 500-volt D.C. test voltage.
   Minimum insulation resistance, 25 megohms.
   b. Rating of equipment of 600 volts: Use 1000-volt D.C. test voltage.
   Minimum insulation resistance, 100 megohms.

3. Wire and Cables Under 600 Volts:

   a. Rating of cables of 300 volts maximum Use 500-volt D.C. test voltage.
   Minimum insulation resistance, 50 meg-ohms.

b. Rating of cables of 600 volts maximum: Use 1000-volt D.C. test voltage. Minimum insulation resistance, 50 meg-ohms.

4. Wire and Cable Over 600 Volts – refer to section 26 05 13.

3.02 TECHNICAL REQUIREMENTS

A. Grounding Systems:

1. Tests include measurement of ground resistance at the following equipment and structures:

a. New main breaker at distribution section of the switchgear.
b. All secondary new Branch circuit panels.
c. Other miscellaneous grounds selected at random in a manner to be representative of the entire installation.
d. Ground system ground rods, including those in manholes.
e. Isolated instrumentation system.

2. Use "3 probe- fall of potential" method ground tests made on system ground rods. All other ground tests may be measured to system ground by use of ground reference method.

3. Verify that ground system installation is completed before performing testing work.

4. Ground circuits showing more than 5 ohms resistance will be considered defective and repaired by the Contractor at his own expense. Provide additional sectionalizing ground rods to achieve required test results. The rods shall be installed 6’-0” apart.

B. Distribution Breakers at existing Distribution board:

1. Electrical Tests:

a. Megger test breaker. Voltage 1000 + 2x rated voltage phase to phase, phase to ground with breaker closed, cross pole breaker open.
b. Check trip free operation.
c. Test trip devices using the primary injection current method. Verify trip timing to manufacturer's specification values. Test values that fail to meet the NETA or manufacturer guidelines: Include equipment, device, test values and failure reason on the daily report submitted to the I.O.R and General Contractor.

C. Ground Fault System:

1. Complete testing work before the initial energization of the service equipment.

D. Thermo graphic Survey:

1. Visual and Mechanical Inspection:

a. Remove all necessary covers prior to scanning.
b. Inspect for physical, electrical, and mechanical condition.

2. Equipment to be scanned as follows:

a. New Panel Boards

E. Contractor’s authorized qualified NETA certified service technician shall provide the testing and operation, adjustments, programming as required.

3.03 RETESTING

A. Retest any equipment which does not pass initial tests, or where subsequent testing is

required for acceptance as directed by the Owner's Representative.

3.04 REPLACEMENT OF DEFECTIVE MATERIAL OR EQUIPMENT

A. Repair or replace any material or equipment found defective or cannot pass the tests specified in this Section at no additional cost to the Owner.

B. Complete correction of defective material or equipment and retesting within the Contract period.

C. If the equipment or material cannot pass the second test, remove the defective equipment, and replace it with equivalent equipment that meets the requirements of the Specifications. Such replacement at no additional cost to the Owner.

D. Remove defective equipment or material from the site no later than 15 days from the date of notification by the Owner or his representative.

END OF SECTION

SECTION 28 31 00

FIRE DETECTION AND VOICE EVACUATION ALARM SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

A. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by 2022 CFC. The system shall be electrically supervised and monitor the integrity of all conductors.

B. The facility shall have an emergency voice alarm communication system. Digitally stored message sequences shall notify the building occupants that a fire or life safety condition has been reported. Message generator(s) shall be capable of automatically distributing up to eight (8) simultaneous, unique messages to appropriate audio zones within the facility based on the type and location of the initiating event. The Fire Command Center (FCC) shall also support Emergency manual voice announcement capability for both system wide or selected audio zones and shall include provisions for the system operator to override automatic messages system wide or in selected zones.

C. The system shall be support additional, alternate Fire Command Centers, which shall be capable of simultaneous monitoring of all system events. Alternate Fire Command Centers shall also support an approved method of transferring the control functions to an alternate Fire Command Center when necessary. All Fire Command Centers shall be individually capable of assuming Audio Command functions such as Emergency Paging, audio zone control functions, and Firefighter's Telephone communication functions.

D. Each designated zone shall transmit separate and different alarm, supervisory and trouble signals to the Fire Command Center (FCC) and designated personnel in other buildings at the site via a multiplex communication network.

E. The fire alarm system shall be manufactured by an ISO 9001:2008 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994

F. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof). It’s acceptable for peripheral devices to be manufactured outside of the U.S. by a division of the U.S. based parent company.

G. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

H. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final checkout and to ensure the systems integrity.

1.3 GUARANTY:

A. The fire alarm control panel, voice panels and any head-end equipment shall have a manufacturer's warranty of a minimum of 3 years.

1.4 POST CONTRACT MAINTENANCE:

A. Complete maintenance and repair service for the fire detection system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.

B. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, required tests, and list pricing for any replacement products included on the bill of materials, along with the list pricing for products not on the bill of materials; if test and inspection rates are different than full service rates the bid/proposal shall include pricing for all levels for a minimum period of five (5) years Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

C. Also include a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

1.5 APPLICABLE STANDARDS AND SPECIFICATIONS:

A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

B. National Fire Protection Association (NFPA) - USA:

No. 12	Extinguishing Systems (low and high)
No. 12A	Halon 1301 Extinguishing Systems
No. 13	Sprinkler Systems
No. 15	Water Spray Systems
No. 16	Foam / Water Deluge and Spray Systems
No. 17	Dry Chemical Extinguishing Systems
No. 17A	Wet Chemical Extinguishing Systems
No. 2001	Clean Agent Extinguishing Systems
No. 70	National Electric Code
No. 90A	Air Conditioning Systems
No. 92A	Smoke Control Systems
No. 92B	Smoke Management Systems in Malls, Atria, Large Areas
No. 72	National Fire Alarm Code
No. 101	Life Safety Code

C. Underwriters Laboratories Inc. (UL) - USA:

No. 268	Smoke Detectors for Fire Protective Signaling Systems

No. 864	Control Units for Fire Protective Signaling Systems
No. 2572	Mass Notification Systems
No. 217	Smoke Detectors, Single and Multiple Station
No. 228	Door Closers - Holders for Fire Protective Signaling Systems
No. 268A	Smoke Detectors for Duct Applications
No. 521	Heat Detectors for Fire Protective Signaling Systems
No. 464	Audible Signaling Appliances
No. 38	Manually Actuated Signaling Boxes
No. 1481	Power Supplies for Fire Protective Signaling Systems
No. 346	Waterflow Indicators for Fire Protective Signaling Systems
No. 1076	Control Units for Burglar Alarm Proprietary Protective Signaling Systems
No. 1971	Visual Notification Appliances
No. 2017	Standard for General-Purpose Signaling Devices and Systems
No.60950	Safety of Information Technology Equipment

D. California 2022 State Building Codes.

E. All requirements of the Authority Having Jurisdiction (AHJ).

1.6 APPROVALS:

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:

UL	Underwriters Laboratories, Inc
ULC	Underwriters Laboratories Canada
FM	Factory Mutual
NYFD	New York Fire Department
CSFM	California State Fire Marshal

B. The system shall be certified for seismic applications in accordance with the California Building Code (CBC). For applications in California the system shall be Pre-Approved for seismic applications from OSHPD. The basis for qualification of seismic approval shall be via shake table testing.

PART 2.0 PRODUCTS

2.1 Main Fire Alarm Control Panel or Network Node:

A. Main FACP or network node shall be a NOTIFIER Model NFS2-640 and shall contain a microprocessor based Central Processing Unit (CPU) and power supply in an economical space saving single board design. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke, Carbon Monoxide (CO) and thermal (heat) detectors, addressable modules, printer, annunciators, and other system-controlled devices.

2.2 System Capacity and General Operation

A. The FACP shall be capable of communicating on Noti-Fire-Net over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels / nodes per network.

B. Each network node shall provide or be capable of 318 intelligent / addressable devices per SLC loop. The Notification Appliance Circuits shall be programmable to Synchronize with System Sensor, Gentex and Wheelock Notification Appliances.

C. The system shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color-coded system status LEDs, and an alphanumeric keypad with easy touch rubber keys for the field programming and control of the fire and gas detection system.

D. The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.

E. The system shall allow the programming of any input to activate any output or group of outputs. Systems that have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or require a laptop personal computer are not considered suitable substitutes.

F. The FACP shall support up to 20 logic equations, including "and" "or," and "not," or time delay equations to be used for advanced programming. Logic equations shall require the use of a PC with a software utility designed for programming.

G. The FACP or each network node shall provide the following features:

1. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
2. Detector sensitivity test, meeting requirements of NFPA 72.
3. Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
4. Up to nine sensitivity levels for alarm, selected by detector. The alarm level range shall be 0.5 to 2.35 percent per foot for photoelectric detectors, 0.5 to 2.5 percent per foot for ionization detectors, 0.5 to 4.0 percent per foot for acclimate detectors and 1.0 to 4.0 percent per foot for multi-criteria (IntelliQuad and IntelliQuad PLUS) detectors. The system shall also support sensitive advanced detection laser detectors with an alarm level range of .02 percent per foot to 2.0 percent per foot. The system shall also include up to nine levels of Pre-alarm, selected by detector, to indicate impending alarms to maintenance personnel.
5. The ability to display or print system reports.
6. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification 20 times.
7. PAS pre-signal, meeting NFPA 72 requirements.
8. Self optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its prealarm level to just above normal peaks.

9. Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
10. Control-by-time for non-fire operations, with holiday schedules.
11. Day/night automatic adjustment of detector sensitivity.
12. Device blink control for sleeping areas.
13. The FACP shall be capable of coding main panel node notification circuits in March Time (120 PPM), Temporal (NFPA 72 A-2-2.2.2), and California Code. Panel notification circuits (NAC 1,2,3 and 4) shall also support Two-Stage operation, Canadian Dual Stage (3 minutes) and Canadian Dual Stage (5 minutes). Two stage operation shall allow 20 Pulses Per Minute (PPM) on alarm and 120 PPM after 5 minutes or when a second device activates. Canadian Dual stage is the same as Two-Stage except will only switch to second stage by activation of Drill Switch 3- or 5-minute timer. The panel shall also provide a coding option that will synchronize specific strobe lights designed to accept a specific "sync pulse."
14. Network Communication
15. For flexibility and to ensure program validity, an optional Windows (TM) based program utility shall be available. This program shall be used to off-line program the system with batch upload/download and have the ability to upgrade the manufacturers (FLASH) system code changes. This program shall also have a verification utility, which scans the program files, identifying possible errors. It shall also have the ability to compare old program files to new ones, identifying differences in the two files to allow complete testing of any system operating changes. This shall be in compliance with the NFPA 72 requirements for testing after system modification.

    a. This utility shall provide the ability to create and print NFPA style Test and Inspection reports
    b. This utility shall provide the ability to create and print Device Maintenance information

16. The 80-character display keypad shall be an easy-to-use QWERTY type keypad, similar to a PC keyboard. This shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
17. When configured with an optional 640-character display the display shall use 10 "soft" keys for screen navigation or to accomplish dedicated programming functions. Full programming access shall require use of a laptop and the proper programming utility. With the 640-display option the system shall support distributed audio amplifiers on the digital audio loop of the Digital Voice Command.

H. Signaling Line Circuits (SLC)

1. Each FACP or FACP network node shall support up to two SLCs. Each SLC interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric, multi-criteria, thermal, laser, fire/CO) and 159 intelligent modules (monitor, control, relay, releasing) for a loop capacity of 318 devices. The addition of the optional second loop shall double the device capacity, supporting a total of 636 devices. Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.

2. CPU shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, prealarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

I. Serial Interfaces

1. The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Information Technology Equipment (ITE) peripherals.

   a. EIA-232 interface shall be used to connect an UL-Listed 40 or 80 column printer. Printers that are not UL-Listed are not considered acceptable substitutes.
   b. The system shall include an EIA-485 port for the serial connection of optional annunciators and remote LCD displays.
   c. The EIA-485 interface may be used for network connection to a proprietary-receiving unit.

J. Digital Voice Command Center

1. The Digital Voice Command Center located with the FACP, shall contain all equipment required for all audio control, emergency telephone system control, signaling and supervisory functions. This shall include speaker zone indication and control, telephone circuit indication and control, digital voice units, microphone, and main telephone handset. The DVC shall support up to 8 channels of voice when configured with Digital Audio Amplifiers and 4 channels of voice when employing the optional analog output card. Each DVC shall support up to 32 digital audio amplifiers.
2. Function: The Voice Command Center equipment shall perform the following functions:

   a. Operate as a supervised multi-channel emergency voice communication system.
   b. Operate as a two-way emergency telephone system control center. Audibly and visually annunciate the active or trouble condition of every speaker circuit and emergency telephone circuit.
   c. Audibly and visually annunciate any trouble condition for digital tone and voice units required for normal operation of the system.
   d. Provide all-call Emergency Paging activities through activation of a single control switch.
   e. As required, provide vectored paging control to specific audio zones via dedicated control switches.
   f. Provide a factory recorded "library" of voice messages and tones in standard WAV. File format, which may be edited and saved on a PC running a current Windows® operating system.
   g. Provide a software utility capable of off-line programming for the DVC operation and the audio message files. This utility shall support the creation of new programs as well as editing and saving existing program files. Uploading or downloading the DVC shall not inhibit the emergency operation of other nodes on the fire alarm network.
   h. Support an optional mode of operation with four analog audio outputs capable of be

ing used with UL 864 fire-listed analog audio amplifiers and SLC controlled switching.

i. The Digital Voice Command shall be modular in construction and shall be capable of being field programmable without requiring the return of any components to the manufacturer and without requiring use of any external computers or other programming equipment.
j. The Digital Voice Command and associated equipment shall be protected against unusually high voltage surges or line transients.

3. The emergency voice alarm communication system shall incorporate a Two-way emergency telephone communication system.

a. Two-way emergency telephone communication circuits shall be supervised for open and short circuit conditions.
b. Two-way emergency telephone (Fire Fighter Telephone) communication shall be supported between the Digital Voice Audio Command Center and up to seven (7) remote Fire Fighter's Telephone locations simultaneously on a telephone riser.
c. Means shall be provided to connect FFT voice communications to the speaker circuits in order to allow voice paging over the speaker circuit from a telephone handset.

K. Audio Amplifiers

1. The Audio Amplifiers will provide Audio Power (@25 Volt RMS or 70 RMS) for distribution to speaker circuits.
2. Multiple audio amplifiers may be mounted in a single enclosure, either to supply incremental audio power, or to function as an automatically switched backup amplifier(s).
3. The audio amplifier shall include an integral power supply, and shall provide built-in LED indicators for the following conditions:

a. Earth Fault on DAP A (Digital Audio Port A)
b. Earth Fault on DAP B (Digital Audio Port B)
c. Audio Amplifier Failure Detected Trouble
d. Active Alarm Bus input
e. Audio Detected on Aux Input A
f. Audio Detected on Aux Input B
g. Audio Detected on Firefighter's Telephone Riser
h. Receiving Audio from digital audio riser
i. Short circuit on speaker circuit 1
j. Short circuit on speaker circuit 2
k. Short circuit on speaker circuit 3
l. Short circuit on speaker circuit 4
m. Data Transmitted on DAP A
n. Data Received on DAP A
o. Data Transmitted on DAP B
p. Data Received on DAP B
q. Board failure
r. Active fiber optic media connection on port A (fiber optic media applications)
s. Active fiber optic media connection on port B (fiber optic media applications)
t. Power supply Earth Fault
u. Power supply 5V present

v. Power supply conditions - Brownout, High Battery, Low Battery, Charger Trouble

4. The audio amplifier shall provide the following built-in controls:

   a. Amplifier Address Selection Switches
   b. Signal Silence of communication loss annunciation Reset
   c. Level adjustment for background music
   d. Enable/Disable for Earth Fault detection on DAP A
   e. Enable/Disable for Earth Fault detection on DAP A
   f. Switch for 2-wire/4-wire FFT riser

5. Adjustment of the correct audio level for the amplifier shall not require any special tools or test equipment.
6. Includes audio input and amplified output supervision, back up input, and automatic switch over function, (if primary amplifier should fail).
7. System shall be capable of backing up digital amplifiers.
8. One-to-one backup shall be provided by either a plug-in amplifier card or a designated backup amplifier of identical model as the primary amplifier.
9. One designated backup amplifier shall be capable of backing up multiple primary amplifiers mounted in the same or adjacent cabinets.
10. Multi-channel operation from a single amplifier shall be supported by the addition of an optional plug-in amplifier card.

L. Audio Message Generator (Prerecorded Voice)/Speaker Control:

1. Each initiating zone or intelligent device shall interface with an emergency voice communication system capable of transmitting a prerecorded voice message to all speakers in the building.
2. Actuation of any alarm initiating device shall cause a prerecorded message to sound over the speakers. The message shall be repeated four (4) times. Pre- and post-message tones shall be supported.
3. A built-in microphone shall be provided to allow paging through speaker circuits.
4. System paging from emergency telephone circuits shall be supported.
5. The audio message generator shall have the following indicators and controls to allow for proper operator understanding and control:
   a. Lamp Test
   b. Trouble
   c. Off-Line Trouble
   d. Microphone Trouble
   e. Phone Trouble
   f. Busy/Wait
   g. Page Inhibited
   h. Pre/Post Announcement Tone

M. Controls with associated LED Indicators:

1. Speaker Switches/Indicators

   a. The speaker circuit control switches/indicators shall include visual indication of active

and trouble status for each speaker circuit in the system.

b. The speaker circuit control panel shall include switches to manually activate or deactivate each speaker circuit in the system.

2. Emergency Two-Way Telephone Control Switches/Indicators

a. The emergency telephone circuit control panel shall include visual indication of active and trouble status for each telephone circuit in the system.
b. The telephone circuit control panel shall include switches to manually activate or deactivate each telephone circuit in the system.

N. Specific System Operations

1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.
2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 0 to 60 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
3. Point Disable: Any addressable device in the system may be enabled or disabled through the system keypad.
4. Point Read: The system shall be able to display or print the following point status diagnostic functions:

a. Device status
b. Device type
c. Custom device label
d. View analog detector values
e. Device zone assignments

5. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 800 events. Up to 200 events shall be dedicated to alarm and the remaining events are general purpose. Systems that do not have dedicated alarm storage, where events are overridden by non-alarm type events, are not suitable substitutes. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.
6. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools, or computer expertise to perform.

7. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
8. Software Zones: The FACP shall support 142 independent programmable software zones
9. The fire alarm control panel shall include a walk test feature. It shall include the ability to test initiating device circuits and notification appliance circuits from the field without returning to the panel to reset the system. Operation shall be as follows:

    a. Alarming an initiating device shall activate programmed outputs, which are selected to participate in walk test, for 3 seconds.
    b. Introducing a trouble into the initiating device shall activate the programmed outputs for 8 seconds.
    c. All devices tested in walk test shall be recorded in the history buffer.

10. Multiple agent releasing zones: The system shall support up to 10 releasing zones to protect against 10 independent hazards. Releasing zones shall provide up to three cross-zone and four abort options to satisfy any local jurisdiction requirements.

11. Mass Notification Override: The system shall be UL 2572 listed for Mass Notification and shall be capable, based on the Risk Analysis, of being programmed so that Mass Notification/Emergency Communications events take precedence over fire alarm events.

O. Conventional Aspirating Detection

1. An optional air aspiration detection system shall be available.
2. The aspirating system shall support multiple sensitivity settings.
3. The aspirating system shall operate from 24 VDC.
4. The aspirating system shall provide alarm and trouble relays used to activate a fire alarm control panel.

P. Aspiration System Interface:

1. The system shall be capable of supporting Interface Modules for integrating Vesda Aspiration detectors into SLC loop of the fire alarm control panel. The Interface Module shall support up to 19 detectors, each SLC loop shall support one interface module.

Q. High Level Aspiration System Interface:

1. The system shall be capable of supporting a High-Level Interface for Vesda Aspirating Detection Systems. The interface shall support up to 100 detectors and allow the fire alarm network to monitor and control events on the aspiration system.

R. Portable Emergency Telephone Handset Jack

1. Portable emergency telephone handset jacks shall be flush mounted on stainless steel plates as indicated on the plans. Jacks shall be approved for emergency telephone system application.
2. Insertion of a portable handset plug into a jack shall send a signal to the fire command center, which shall audibly and visually indicate the on-line condition, and shall sound a "ring" indication in the handset.
3. The two-way emergency telephone system shall support a minimum of seven (7) handsets on line without degradation of the signal.

S. Fixed Emergency Telephone Handset

1. The telephone cabinet shall be painted red and clearly labeled as "Emergency Telephone." The cabinets shall be located where shown on drawings.
2. The handset cradle shall have a switch connection so that lifting the handset off of the cradle shall send a signal to the fire command center, which shall audibly and visually indicate its on-line (off-hook) condition.
3. On activating the remote phone, the phone earpiece shall sound a telephone ring signal until the master handset is lifted.
4. The two-way emergency telephone system shall support a minimum of seven (7) handsets on line without degradation of the signal.

T. All interfaces and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with UL standard 864.

U. Communicators

1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.
2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to two different telephone numbers.

The UDACT shall be capable of transmitting events in 4+2, SIA, and Contact ID. Communication shall include vital system status such as:

a. Independent Zone (Alarm, trouble, non-alarm, supervisory)
b. Independent Addressable Device Status
c. AC (Mains) Power Loss
d. Low Battery and Earth Fault
e. System Off Normal
f. 12- and 24-Hour Test Signal
g. Abnormal Test Signal (per UL requirements)
h. EIA-485 Communications Failure
i. Phone Line Failure

3. The UDACT shall support independent zone/point reporting when used in the Contact ID

format. In this format the UDACT shall support transmission of up to 3,064 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.

4. The UDACT shall be capable of being programmed with the same programming utility as the host FACP, and saved, edited, and uploaded and downloaded using the utility. UDACT shall be capable of being programmed online or offline. The programming utility shall also support upgrading UDACT operating firmware.
5. The UDACT shall be capable of generating Central Station reports providing detailed programming information for each point along with the central station point address.
6. An IP or IP/GSM Communicator option shall be available to interface to the UDACT and be capable of transmitting signals over the internet/intranet or Cellular (GSM) network to a compatible receiver.

2.3 Gateway & Webserver Options

A. Common Alerting Protocol (CAP) Gateway: The system shall support an optional CAP Gateway (Common Alerting Protocol). The CAP Gateway translates fire system messages to industry standard CAP messages for integration with CAP-compliant clients. A CAP gateway shall be available from the fire alarm control panel manufacturer.

B. LEDSIGN Gateway: The system shall support an optional and proprietary LEDSIGN Gateway to interface to LED signs that will automatically display emergency messages. The signs shall be capable of storing up to 100 messages that can be activated via system programming with the ability to be manually overridden. The Sign Gateway shall support up to 10 independent signs, each sign capable of playing an independent message. Multiple LEDSIGN Gateways can be used in network applications. An LEDSIGN gateway shall be available from the fire alarm control panel manufacturer.

C. BACnet Interface Gateway: The system shall be capable of being interfaced with BACNet compliant clients. A BACnet interface supporting BACnet/IP communication shall be available from the fire alarm control panel manufacturer.

D. MODbus Interface Gateway: The system shall be capable of being interfaced with MODbus compliant clients. A MODbus interface supporting MODbus/TCP communication shall be available from the fire alarm control panel manufacturer.

E. Noti-Fire-Net Gateway: The system shall support an IP based gateway to enable the panel or local Noti-Fire-Net to be connected to an ONYXWorks workstation via the Internet or Intranet. This gateway shall also support the ability to integrate the system to an interactive firefighter's display. The Noti-Fire-Net Gateway shall be available from the fire alarm control manufacturer.

F. Webserver: The system shall support a webserver allowing remote connection via the Internet or Intranet. Authorized users will have the ability to view panel/network history, event status and device properties. The webserver shall also support sending event information via email or text to up to 50 registered users, the webserver shall be available from the fire alarm control panel manufacturer.

G. Web Portal Interface: The system shall be capable of being interfaced with a web portal to integrate with Inspection and Service Manager utilities. The web portal and inspection and service manager utilities shall be available from the fire alarm control panel manufacturer.

2.4 System Components - Addressable Devices Refer to Fire Alarm Equipment Schedule for Specific Models provided.

A. Addressable Devices - General

1. Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.
2. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.
3. Detectors shall be intelligent (analog) and addressable and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
4. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.
6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
7. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications. The system shall also support an intelligent programmable sounder base, the programmable sounder base shall be capable of providing multiple tones based on programming and at a minimum be capable of providing a Temp-4 tone for CO (Carbon Monoxide) activation and a Temp-3 tone for fire activations and be capable of being synchronized with other programmable sounder bases and common area notification appliances; 85 DBA minimum.
8. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
9. Detectors shall also store an internal identifying type of code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
10. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.

11. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
12. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
13. Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.

B. Addressable Manual Fire Alarm Box (manual station)

1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status; NOTIFIER model # NBG-12LX. They shall use a key operated test-reset lock and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

C. Intelligent Photoelectric Smoke Detector: The intelligent photoelectric smoke detector shall be NOTIFIER model # FSP-951 and shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

D. Intelligent Thermal Detectors: The intelligent thermal detectors shall be NOTIFIER FST- 951R series addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. A high heat thermal detector rated at 190 degrees Fahrenheit shall also be available. The thermal detectors shall connect via two wires to the fire alarm control panel signaling line circuit.

E IntelliQuad™ PLUS Advanced Multi-Criteria Intelligent Fire/CO Detector (if applicable).

1. Advanced Multi-Criteria Fire/CO detector shall be NOTIFIER model # FCO-851 and shall be an addressable advanced multi-criteria smoke detector with a separate signal for carbon monoxide (CO) detection per UL 2075 standards.

2. The detector shall be comprised of four sensing elements, including a photoelectric (light-scattering) particulate sensor, an electrochemical CO sensor, a daylight-filtered infrared (IR) sensor and solid-state thermal sensor(s) rated at 135°F (57.2°C). The device shall be able to indicate distinct smoke and heat alarms.

3. The advanced multi-criteria detection device shall include the ability to combine the signal of the photoelectric signal with other sensing elements in order to react quickly in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a nuisance alarm condition. The detector shall be capable of selecting the appropriate sensitivity levels based on the environment type (office, manufacturing, kitchen, etc.) in which it is installed, and then have the ability to automatically change the setting as the environment changes.

4. The CO detector component shall be capable of a functional gas test using a canned test agent to test the functionality of the CO sensing cell.
5. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The device shall provide unique signals to indicate when 20 percent of the drift range is remaining, when 100 percent of drift range is used, and when there is a chamber fault to show the unit requires maintenance.
6. The detector shall indicate CO trouble conditions, including six months of sensor life remaining and sensor life has expired. The detector shall indicate a combined signal for any of the following: low chamber trouble, thermistor trouble, CO self test failure, IR self test failure, and freeze warning.
7. The detector shall provide address-setting means on the detector head using rotary switches. Because of the possibility of installation error, systems that use binary jumpers or DIP switches to set the detector address are not acceptable. The detector shall also store an internal identifying code that the control panel shall use to identify the type of detector. Systems that require a special programmer to set the detector address (including temporary connection at the panel) are labor intensive and not acceptable. Each detector occupies any one of at least 159 possible addresses on the signaling line circuit (SLC) loop. It responds to regular polls from the system and reports its type and status.
8. The detector shall provide a test means whereby it will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a switch) or initiated remotely on command from the control panel. There shall be four test methods: functional magnet, smoke entry aerosol, carbon monoxide aerosol or direct heat method.
9. The detector shall provide two LEDs to provide 360° visibility. The LEDs shall be placed into steady red illumination by the control panel indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED. The detector must be capable of connecting to a sounder base that provides both temporal 3 and temporal 4 patterns for fire and CO alarm.
10. Two LEDs on the sensor shall be controlled by the panel to indicate sensor status. Coded signals, transmitted from the panel, shall cause the LEDs to blink, latch on, or latch off. Refer to the control panel technical documentation for sensor LED status operation and expected delay to alarm.
11. The detector shall be plug-in mounted into a twist-lock base. The detector shall be constructed of off-white, UV-resistant polymer and shall be detachable from the mounting base to simplify installation, service and maintenance. Mounting base wiring connections shall be made by means of SEMS screws. The detector shall allow pre-wiring of the base and the head shall be a plug-in type. The mounting base shall be mounted on a junction box that is at least 1.5 inches (3.81 cm) deep. The mounting base shall be available to mount to standard junction boxes. Suitable boxes include:

    a. 4.0" (10.16 cm) square box with and without plaster ring.
    b. 4.0" (10.16 cm) octagonal box.
    c. 3.5" (8.89 cm) octagonal box.
    d. Single-gang box.
    e. Double-gang box

12. Meets Agency Standards

a. ANSI/UL 268 -Smoke Detectors for Fire Alarm Signaling Systems
b. CAN/ULC-S529- Smoke Detectors for Fire Alarm Systems
c. FM 3230-3250- Smoke Actuated Detectors for Automatic Fire Alarm Signaling
d. UL 2075 – Gas and Vapor Detector and Sensors – Systems Connected

F. Intelligent Addressable Reflected Beam Detector

1. The intelligent single-ended reflected beam smoke detector shall connect with two wires to the fire alarm control panel signaling line circuit (SLC). The detectors shall consist of a transmitter/receiver unit and a reflector and shall send data to the panel representing the analog level of smoke density. The detector shall be capable of being tested remotely via a key switch; NOTIFIER model # FS-OSI-RI. Model # RTS151KEY shall be equipped with an integral sensitivity test feature

M. Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs. The addressable monitor module shall be NOTIFIER model # FMM-1 (Class A or B) or FMM-101 (Class B)
2. The IDC zone shall be suitable for Style D/Class A or Style B/Class B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4-inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.
4. For multiple dry contact monitoring a module shall be available that provides 10 Style B or 5 Style D input circuits: NOTIFIER model # XP10-M.

N. Two Wire Detector Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device); NOTIFIER model # FZM-1.
2. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
3. For multiple 2-wire smoke detector circuit monitoring a module shall be available that provides 6 Style B/Class A or 3 Style D/Class B input circuits: NOTIFIER model # XP6-MA

O. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional circuit of compatible Notification Appliances, 24 VDC powered, polarized audio/visual notification appliances: NOTIFIER model # FCM-1
2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with a current rating of 2 Amps for Style Z and 3 Amps for Style Y;

3. Audio/visual power shall be provided by a separate supervised circuit from the main fire alarm control panel or from a supervised UL listed remote supply.
4. For multiple circuit control a module shall be available that provides 6 Style Y (Class B) or 3 Style Z (Class A) control circuits; NOTIFIER model # XP6-C.

P. Addressable Relay Module:

1. Addressable Relay Modules shall be available for HVAC control and other network building functions; NOTIFIER model # FRM-1.
2. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.
3. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary devices energize at the same time on the same pair of wires.
4. For multiple relay control a module shall be available that provides 6 programmable Form-C relays: NOTIFIER model # XP6-R

Q. Isolator Module: Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building: NOTIFIER model # ISO-X.

1. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
2. The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
3. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

R. Notification Devices: Refer to Fire Alarm Equipment Schedule for Specific Models provided.

Speakers:

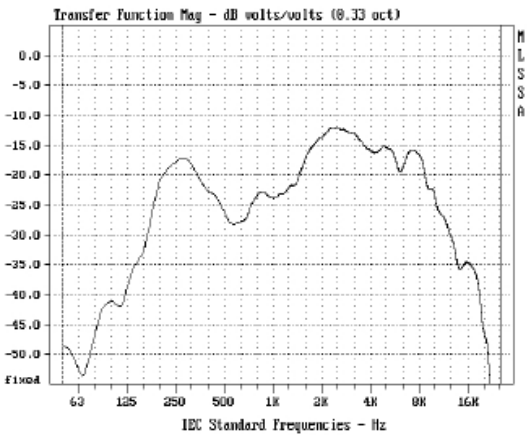
1. The Speaker appliance shall be System Sensor series Speaker. The speaker shall be listed to UL 1480 for Fire Protective Signaling Systems. It shall be a dual-voltage transformer speaker capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
2. A universal mounting plate shall be used for mounting ceiling and wall speaker products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
3. Speakers shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper re

sistance via an open circuit if the device is removed. Speaker design shall isolate speaker components to reduce ground fault incidents.

4. The speaker shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction.
5. All notification appliances shall be backward compatible.

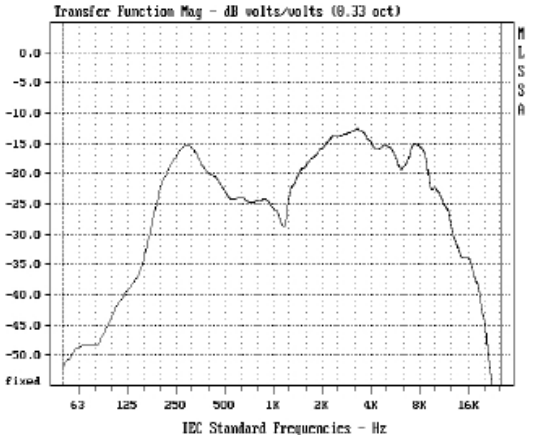
Ceiling Speaker

Wide Band Frequency Response



Wall Speaker

Wide Band Frequency Response



Note: The wide band frequency response is derived using MLS methods

S. Speaker Strobes:

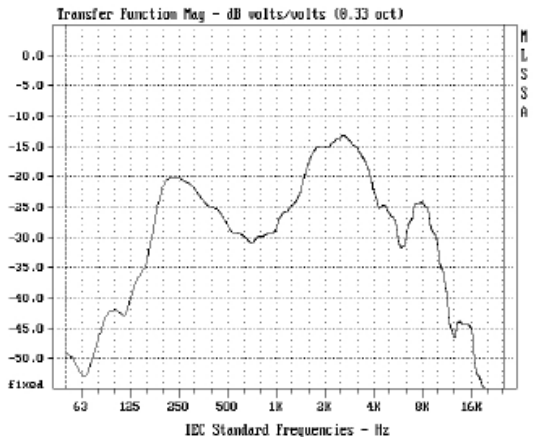
1. The Speaker Strobe appliance shall be System Sensor SPSCWL- P/SPSWL-P series wall/ceiling Speaker Strobe. The speaker strobe shall be listed to UL 1971 and UL 1480 and be approved for fire protective signaling systems. It shall be a dual-voltage transformer speaker strobe capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
2. A universal mounting plate shall be used for mounting ceiling and wall speaker strobe products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate. Also, SpectrAlert Advance speaker strobes and the Sync Circuit™ Module MDL3 accessory, if used, shall be powered from a non-coded notification appliance circuit output and shall operate on a nominal 12 or 24 volts (includes fire alarm panels with built in sync). When used with the Sync Circuit Module MDL3, 12-volt rated notification appliance circuit outputs shall operate between 8.5 and 17.5 volts; 24-volt rated notification appliance circuit outputs shall operate between 16.5 to 33 volts. If the notification appliances are not UL 9th edition listed with the corresponding panel or power supply being used, then refer to the compatibility listing of the panel to determine maximum devices on a circuit.
3. Speaker strobes shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker strobe design shall iso

late speaker components to reduce ground fault incidents.

4. The speaker strobe shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction. The strobe shall consist of a xenon flash tube with associated lens/reflector system and operate on either 12V or 24V. The strobe shall also feature selectable candela output, providing options for 15 or 15/75 candela when operating on 12V and 15, 15/75, 30, 75, 110, or 115 when operating on 24V. The strobe shall comply with NFPA 72 and the Americans with Disabilities Act requirement for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range.
5. All notification appliances shall be backward compatible.

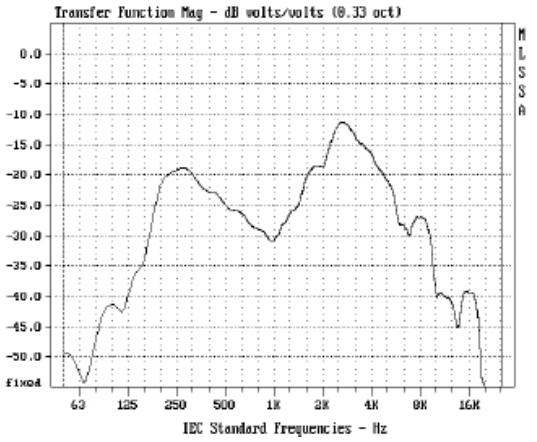
Ceiling Speaker Strobe

Wide Band Frequency Response



Wall Speaker Strobe

Wide Band Frequency Response



Note: The wide band frequency response is derived using MLS methods

6. Strobe lights shall meet the requirements of the ADA, UL Standard 1971and be fully synchronized.

PART 3.0 - EXECUTION

3.1. INSTALLATION:

A. Installation shall be in accordance with the CEC, CFC, NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. All conduit, junction boxes, conduit supports, and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the sys

tem programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

D. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.2. TEST:

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72.

A. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

B. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

C. Verify activation of all waterflow switches.

D. Open initiating device circuits and verify that the trouble signal actuates.

E. Open and short signaling line circuits and verify that the trouble signal actuates.

F. Open and short notification appliance circuits and verify that trouble signal actuates.

G. Ground all circuits and verify response of trouble signals.

H. Check presence and audibility of tone at all alarm notification devices.

I. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.

J. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

K. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3. FINAL INSPECTION:

A. At the final inspection, a factory-trained representative of the manufacturer of the major equip

ment shall demonstrate that the system functions properly in every respect.

3.4. INSTRUCTION:

A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation." Installed at control panel with laminated cover.

END OF SECTION

SYSTEM RECORD OF COMPLETION

This form is to be completed by the system installation contractor at the time of system acceptance and approval.
It shall be permitted to modify this form as needed to provide a more complete and/or clear record.
Insert N/A in all unused lines.
Attach additional sheets, data, or calculations as necessary to provide a complete record.

Form Completion Date: _____ Supplemental Pages Attached: _____

1. PROPERTY INFORMATION

Name of property: _____

Address: _____

Description of property: _____

Name of property representative: _____

Address: _____

Phone: _____ Fax: _____ E-mail: _____

2. INSTALLATION, SERVICE, TESTING, AND MONITORING INFORMATION

Installation contractor: _____

Address: _____

Phone: _____ Fax: _____ E-mail: _____

Service organization: _____

Address: _____

Phone: _____ Fax: _____ E-mail: _____

Testing organization: _____

Address: _____

Phone: _____ Fax: _____ E-mail: _____

Effective date for test and inspection contract: _____

Monitoring organization: _____

Address: _____

Phone: _____ Fax: _____ E-mail: _____

Account number: _____ Phone line 1: _____ Phone line 2: _____

Means of transmission: _____

Entity to which alarms are retransmitted: _____ Phone: _____

3. DOCUMENTATION

On-site location of the required record documents and site-specific software: _____

4. DESCRIPTION OF SYSTEM OR SERVICE

This is a: ☐ New system ☐ Modification to existing system Permit number: _____

NFPA 72 edition: _____

4.1 Control Unit

Manufacturer: _____ Model number: _____

4.2 Software and Firmware

Firmware revision number: _____

4.3 Alarm Verification

☐ This system does not incorporate alarm verification.

Number of devices subject to alarm verification: _____ Alarm verification set for _____ seconds

5. SYSTEM POWER

5.1 Control Unit

5.1.1 Primary Power

Input voltage of control panel: _____ Control panel amps: _____

Overcurrent protection: Type: _____ Amps: _____

Branch circuit disconnecting means location: _____ Number: _____

5.1.2 Secondary Power

Type of secondary power: _____

Location, if remote from the plant: _____

Calculated capacity of secondary power to drive the system:

In standby mode (hours): _____ In alarm mode (minutes): _____

5.2 Control Unit

☐ This system does not have power extender panels

☐ Power extender panels are listed on supplementary sheet A

6. CIRCUITS AND PATHWAYS

Pathway Type	Dual Media Pathway	Separate Pathway	Class	Survivability Level
Signaling Line				
Device Power				
Initiating Device				
Notification Appliance				
Other (specify):				

7. REMOTE ANNUNCIATORS

Type	Location

8. INITIATING DEVICES

Type	Quantity	Addressable or Conventional	Alarm or Supervisory	Sensing Technology
Manual Pull Stations				
Smoke Detectors				
Duct Smoke Detectors				
Heat Detectors				
Gas Detectors				
Waterflow Switches				
Tamper Switches				

9. NOTIFICATION APPLIANCES

Type	Quantity	Description
Audible		
Visible		
Combination Audible and Visible		

10. SYSTEM CONTROL FUNCTIONS

Type	Quantity
Hold-Open Door Releasing Devices	
HVAC Shutdown	
Fire/Smoke Dampers	
Door Unlocking	
Elevator Recall	
Elevator Shunt Trip	

11. INTERCONNECTED SYSTEMS

☐ This system does not have interconnected systems.

☐ Interconnected systems are listed on supplementary sheet _____ .

12. CERTIFICATION AND APPROVALS

12.1 System Installation Contractor

This system as specified herein has been installed according to all NFPA standards cited herein.

Signed: _____ Printed name: _____ Date: _____

Organization: _____ Title: _____ Phone: _____

12.2 System Operational Test

This system as specified herein has tested according to all NFPA standards cited herein.

Signed: _____ Printed name: _____ Date: _____

Organization: _____ Title: _____ Phone: _____

12.3 Acceptance Test

Date and time of acceptance test: _____

Installing contractor representative: _____

Testing contractor representative: _____

Property representative: _____

AHJ representative: _____

EMERGENCY COMMUNICATIONS SYSTEMS
SUPPLEMENTARY RECORD OF COMPLETION

This form is a supplement to the System Record of Completion. It includes systems and components specific to emergency communications systems.
This form is to be completed by the system installation contractor at the time of system acceptance and approval.
It shall be permitted to modify this form as needed to provide a more complete and/or clear record.
Insert N/A in all unused lines.

Form Completion Date: _____ Number of Supplemental Pages Attached: _____

1. PROPERTY INFORMATION

Name of property: _____

Address: _____

2. DESCRIPTION OF SYSTEM OR SERVICE

☐ Fire alarm with in-building fire emergency voice alarm communication system (EVAC)

☐ Mass notification system

☐ Combination system, with the following components:

☐ Fire alarm ☐ EVACS ☐ MNS ☐ Two-way, in-building, emergency communications system

☐ Other (specify): _____

NFPA 72 edition: _____ Additional description of system(s): _____

2.1 In-Building Fire Emergency Voice Alarm Communications System

Manufacturer: _____ Model number: _____

Number of single voice alarm channels: _____ Number of multiple voice alarm channels: _____

Number of speakers: _____ Number of speaker circuits: _____

Location of amplification and sound processing equipment:

_____

Location of paging microphone stations:

Location 1: _____

Location 2: _____

Location 3: _____

2.2 Mass Notification System

2.2.1 System Type:

☐ In-building MNS–combination

☐ In-building MNS ☐ Wide-area MNS ☐ Distributed recipient MNS

☐ Other (specify): _____

2. DESCRIPTION OF SYSTEM OR SERVICE *(continued)*

2.2.2 System Features:

☐ Combination fire alarm/MNS ☐ MNS autonomous control unit ☐ Wide-area MNS to regional national alerting interface

☐ Local operating console (LOC) ☐ Distributed-recipient MNS (DRMNS) ☐ Wide-area MNS to DRMNS interface

☐ Wide-area MNS to high power speaker array (HPSA) interface ☐ In-building MNS to wide-area MNS interface

☐ Other (specify): _____

2.2.3 MNS Local Operating Consoles

Location 1: _____

Location 2: _____

Location 3: _____

2.2.4 High Power Speaker Arrays

Number of HPSA speaker initiation zones: _____

Location 1: _____

Location 2: _____

Location 3: _____

2.2.5 Mass Notification Devices

Combination fire alarm/MNS visual devices: _____ MNS-only visual devices: _____

Textual signs: _____ Other (describe): _____

Supervision class: _____

2.2.6 Special Hazard Notification

☐ This system does not have special suppression predischarge notification.

☐ MNS systems DO NOT override notification appliances required to provide special suppression predischarge notification.

3. TWO-WAY EMERGENCY COMMUNICATIONS SYSTEMS

3.1 Telephone System

Number of telephone jacks installed: _____ Number of warden stations installed: _____

Number of telephone handsets stored on site: _____

Type of telephone system installed: ☐ Electrically powered ☐ Sound powered

3.2 Two-Way Radio Communications Enhancement System

Percentage of area covered by two-way radio service: Critical areas _____ % General building areas _____ %

Amplification component locations: _____

Inbound signal strength _____ dBm Outbound signal strength _____ dBm

Donor antenna isolation is _____ dB above the signal booster gain.

Radio frequencies covered: _____

Radio system monitor panel location: _____

3. TWO-WAY EMERGENCY COMMUNICATIONS SYSTEMS *(continued)*

3.3 Area of Refuge (Area of Rescue Assistance) Emergency Communications Systems

Number of stations: _____ Location of central control point: _____

Days and hours when central control point is attended: _____

Location of alternate control point: _____

Days and hours when alternate control point is attended: _____

3.4 Elevator Emergency Communications Systems

Number of elevators with stations: _____ Location of central control point: _____

Days and hours when central control point is attended: _____

Location of alternate control point: _____

Days and hours when alternate control point is attended: _____

3.5 Other Two-Way Communications System

Describe: _____

4. CONTROL FUNCTIONS

This system activates the following control functions specific to emergency communications systems:

Type	Quantity
Mass Notification Override of Alarm Signaling Systems or Appliances	

See Main System Record of Completion for additional information, certifications, and approvals.

POWER SYSTEMS
SUPPLEMENTARY RECORD OF COMPLETION

This form is a supplement to the System Record of Completion. It includes systems and components specific to power systems that incorporate generators, UPS systems, remote battery systems, or other complex power systems. This form is to be completed by the system installation contractor at the time of system acceptance and approval. It shall be permitted to modify this form as needed to provide a more complete and/or clear record. Insert N/A in all unused lines.

Form Completion Date: _____ Number of Supplemental Pages Attached: _____

1. PROPERTY INFORMATION

Name of property: _____

Address: _____

2. SYSTEM POWER

2.1 Control Unit

2.1.1 Primary Power

Input voltage of control panel: _____ Control panel amps: _____

Overcurrent protection: Type: _____ Amps: _____

Location (of primary supply panelboard): _____

Disconnecting means location: _____

2.1.2 Engine-Driven Generator

Location of generator: _____

Location of fuel storage: _____ Type of fuel: _____

2.1.3 Uninterruptible Power System

Equipment powered by UPS system: _____

Location of UPS system: _____

Calculated capacity of UPS batteries to drive the system components connected to it:

In standby mode (hours): _____ In alarm mode (minutes): _____

2.1.4 Batteries

Location: _____ Type: _____ Nominal voltage: _____ Amp/hour rating: _____

Calculated capacity of batteries to drive the system:

In standby mode (hours): _____ In alarm mode (minutes): _____

2.2 In-Building Fire Emergency Voice Alarm Communications System or Mass Notification System

2.2.1 Primary Power

Input voltage of EVACS or MNS panel: _____ EVACS or MNS amps: _____

Overcurrent protection: Type: _____ Amps: _____

Location (of primary supply panelboard): _____

Disconnecting means location: _____

2. SYSTEM POWER *(continued)*

2.2.2 Engine-Driven Generator

Location of generator: _____

Location of fuel storage: _____ Type of fuel: _____

2.2.3 Uninterruptible Power System

Equipment powered by UPS system: _____

Location of UPS system: _____

Calculated capacity of UPS batteries to drive the system components connected to it:

In standby mode (hours): _____ In alarm mode (minutes): _____

2.2.4 Batteries

Location: _____ Type: _____ Nominal voltage: _____ Amp/hour rating: _____

Calculated capacity of batteries to drive the system:

In standby mode (hours): _____ In alarm mode (minutes): _____

2.3 Notification Appliance Power Extender Panels

☐ This system does not have power extender panels.

2.3.1 Primary Power

Input voltage of power extender panel(s): _____ Power extender panel amps: _____

Overcurrent protection: Type: _____ Amps: _____

Location (of primary supply panelboard): _____

Disconnecting means location: _____

2.3.2 Engine-Driven Generator

Location of generator: _____

Location of fuel storage: _____ Type of fuel: _____

2.3.3 Uninterruptible Power System

Equipment powered by UPS system: _____

Location of UPS system: _____

Calculated capacity of UPS batteries to drive the system components connected to it:

In standby mode (hours): _____ In alarm mode (minutes): _____

2.3.4 Batteries

Location: _____ Type: _____ Nominal voltage: _____ Amp/hour rating: _____

Calculated capacity of batteries to drive the system:

In standby mode (hours): _____ In alarm mode (minutes): _____

See Main System Record of Completion for additional information, certifications, and approvals.

NOTIFICATION APPLIANCE POWER PANEL
SUPPLEMENTARY RECORD OF COMPLETION

This form is a supplement to the System Record of Completion. It includes a list of types and locations of notification appliance power extender panels.
This form is to be completed by the system installation contractor at the time of system acceptance and approval.
It shall be permitted to modify this form as needed to provide a more complete and/or clear record.
Insert N/A in all unused lines.

Form Completion Date: _____ Number of Supplemental Pages Attached: _____

1. PROPERTY INFORMATION

Name of property: _____

Address: _____

2. NOTIFICATION APPLIANCE POWER EXTENDER PANELS

Make and Model	Location	Area Served	Power Source

See Main System Record of Completion for additional information, certifications, and approvals.

INTERCONNECTED SYSTEMS
SUPPLEMENTARY RECORD OF COMPLETION

This form is a supplement to the System Record of Completion. It includes a list of types and locations of systems that are interconnected to the main system.
This form is to be completed by the system installation contractor at the time of system acceptance and approval.
It shall be permitted to modify this form as needed to provide a more complete and/or clear record.
Insert N/A in all unused lines.

Form Completion Date: _____ Number of Supplemental Pages Attached: _____

1. PROPERTY INFORMATION

Name of property: _____

Address: _____

2. INTERCONNECTED SYSTEMS

Description	Location	Purpose

See Main System Record of Completion for additional information, certifications, and approvals.

DEVIATIONS FROM ADOPTED CODES AND STANDARDS
SUPPLEMENTARY RECORD OF COMPLETION

This form is a supplement to the System Record of Completion. It enables the designer and/or installer to document and justify deviations from accepted codes or standards.
This form is to be completed by the system installation contractor at the time of system acceptance and approval.
It shall be permitted to modify this form as needed to provide a more complete and/or clear record.
Insert N/A in all unused lines.

Form Completion Date: _____ Number of Supplemental Pages Attached: _____

1. PROPERTY INFORMATION

Name of property: _____

Address: _____

2. DEVIATIONS FROM ADOPTED CODES OR STANDARDS

Description	Purpose

See Main System Record of Completion for additional information, certifications, and approvals.

SYSTEM RECORD OF INSPECTION AND TESTING

This form is to be completed by the system inspection and testing contractor at the time of a system test.
It shall be permitted to modify this form as needed to provide a more complete and/or clear record.
Insert N/A in all unused lines.
Attach additional sheets, data, or calculations as necessary to provide a complete record.

Inspection/Test Start Date/Time: _____ Inspection/Test Completion Date/Time: _____

Supplemental Form(s) Attached: _____ (yes/no)

1. PROPERTY INFORMATION

Name of property: _____

Address: _____

Description of property: _____

Name of property representative: _____

Address: _____

Phone: _____ Fax: _____ E-mail: _____

2. TESTING AND MONITORING INFORMATION

Testing organization: _____

Address: _____

Phone: _____ Fax: _____ E-mail: _____

Monitoring organization: _____

Address: _____

Phone: _____ Fax: _____ E-mail: _____

Account number: _____ Phone line 1: _____ Phone line 2: _____

Means of transmission: _____

Entity to which alarms are retransmitted: _____ Phone: _____

3. DOCUMENTATION

On-site location of the required record documents and site-specific software: _____

4. DESCRIPTION OF SYSTEM OR SERVICE

4.1 Control Unit

Manufacturer: _____ Model number: _____

4.2 Software and Firmware

Firmware revision number: _____

4.3 System Power

4.3.1 Primary (Main) Power

Nominal voltage: _____ Amps: _____ Location: _____

Overcurrent protection type: _____ Amps: _____ Disconnecting means location: _____

4. DESCRIPTION OF SYSTEM OR SERVICE *(continued)*

4.3.2 Secondary Power

Type: _____ Location: _____

Battery type (if applicable): _____

Calculated capacity of batteries to drive the system:

In standby mode (hours): _____ In alarm mode (minutes): _____

5. NOTIFICATIONS MADE PRIOR TO TESTING

Monitoring organization	Contact:	_____	Time:	_____
Building management	Contact:	_____	Time:	_____
Building occupants	Contact:	_____	Time:	_____
Authority having jurisdiction	Contact:	_____	Time:	_____
Other, if required	Contact:	_____	Time:	_____

6. TESTING RESULTS

6.1 Control Unit and Related Equipment

Description	Visual Inspection	Functional Test	Comments
Control unit	☐	☐	
Lamps/LEDs/LCDs	☐	☐	
Fuses	☐	☐	
Trouble signals	☐	☐	
Disconnect switches	☐	☐	
Ground-fault monitoring	☐	☐	
Supervision	☐	☐	
Local annunciator	☐	☐	
Remote annunciators	☐	☐	
Remote power panels	☐	☐	
	☐	☐	

6.2 Secondary Power

Description	Visual Inspection	Functional Test	Comments
Battery condition	☐	☐	
Load voltage	☐	☐	
Discharge test	☐	☐	
Charger test	☐	☐	
Remote panel batteries	☐	☐	

6. TESTING RESULTS *(continued)*

6.3 Alarm and Supervisory Alarm Initiating Device

Attach supplementary device test sheets for all initiating devices.

6.4 Notification Appliances

Attach supplementary appliance test sheets for all notification appliances.

6.5 Interface Equipment

Attach supplementary interface component test sheets for all interface components.

Circuit Interface / Signaling Line Circuit Interface / Fire Alarm Control Interface

6.6 Supervising Station Monitoring

Description	Yes	No	Time	Comments
Alarm signal	☐	☐		
Alarm restoration	☐	☐		
Trouble signal	☐	☐		
Trouble restoration	☐	☐		
Supervisory signal	☐	☐		
Supervisory restoration	☐	☐		

6.7 Public Emergency Alarm Reporting System

Description	Yes	No	Time	Comments
Alarm signal	☐	☐		
Alarm restoration	☐	☐		
Trouble signal	☐	☐		
Trouble restoration	☐	☐		
Supervisory signal	☐	☐		
Supervisory restoration	☐	☐		

7. NOTIFICATIONS THAT TESTING IS COMPLETE

Monitoring organization	Contact:	_____	Time:	_____
Building management	Contact:	_____	Time:	_____
Building occupants	Contact:	_____	Time:	_____
Authority having jurisdiction	Contact:	_____	Time:	_____
Other, if required	Contact:	_____	Time:	_____

8. SYSTEM RESTORED TO NORMAL OPERATION

Date: _____ Time: _____

9. CERTIFICATION

This system as specified herein has been inspected and tested according to NFPA 72, 2013 edition, Chapter 14.

Signed: _____ Printed name: _____ Date: _____

Organization: _____ Title: _____ Phone: _____

Qualifications (refer to 10.5.3): _____

10. DEFECTS OR MALFUNCTIONS NOT CORRECTED AT CONCLUSION OF SYSTEM INSPECTION, TESTING, OR MAINTENANCE

_____

_____

_____

_____

_____

_____

_____

10.1 Acceptance by Owner or Owner's Representative:

The undersigned accepted the test report for the system as specified herein:

Signed: _____ Printed name: _____ Date: _____

Organization: _____ Title: _____ Phone: _____

NOTIFICATION APPLIANCE
SUPPLEMENTARY RECORD OF INSPECTION AND TESTING

This form is a supplement to the System Record of Inspection and Testing.
It includes a notification appliance test record.
This form is to be completed by the system inspection and testing contractor at the time of the inspection and/or test.
It shall be permitted to modify this form as needed to provide a more complete and/or clear record.
Insert N/A in all unused lines.

Inspection/Test Start Date/Time: _____ Inspection/Test Completion Date/Time: _____

Number of Supplemental Pages Attached: _____

1. PROPERTY INFORMATION

Name of property: _____

Address: _____

2. NOTIFICATION APPLIANCE TEST RESULTS

Appliance Type	Location/Identifier	Test Results

NOTIFICATION APPLIANCE
SUPPLEMENTARY RECORD OF INSPECTION AND TESTING *(continued)*

2. NOTIFICATION APPLIANCE TEST RESULTS *(continued)*

Appliance Type	Location/Identifier	Test Results

See main System Record of Inspection and Testing for additional information, certifications, and approvals.

SECTION 31 2323

EXCAVATION AND FILL FOR UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Excavating, backfilling, and compacting utility trenches such as water, gas, irrigation, storm drain, sewer lines, concrete-encased conduits, and manholes, vaults, valve boxes, catch basins, underground tanks, thrust blocks, yard boxes, pull boxes and other utility appurtenances.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 32 0117 - Pavement Repair.

3. Section 32 1313 - Site Concrete Work.

4. Division 22 - Plumbing.

5. Division 26 - Electrical.

1.02 PROJECT REQUIREMENTS

A. Import and Export of Earth Materials:

1. Fees: Pay as required by authorities having jurisdiction over the area.

2. Bonds: Post as required by authorities having jurisdiction over the area.

3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement: Standard Specifications for Public Works construction, current edition except as modified herein.

1.04 TESTING

A. OWNER will retain a Geotechnical Engineer as an OWNER Consultant who will provide observations, tests, inspections and approvals identified in the Contract Documents as being responsibility of OWNER.

B. Imported Soils: The Geotechnical Engineer will obtain initial product Sample for testing in accordance Article 3.02 of this Section.

1.05 PROJECT CONDITIONS

A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Bedding material from trench bottom to one foot above the pipe:

1. Sand, gravel, crushed aggregate or native free-draining granular material providing a sand equivalent of at least 30 or a coefficient of permeability greater than 1.4 inches per hour.

2. Sand complying with the Specifications for cement concrete aggregates.

B. Backfill Materials:

1. Excavated trench material to be installed for backfilling shall be clean, free of large clods, and stones larger than 2 ½-inch in any dimension.

2. Cement-sand slurry shall be provided with one sack of cement per cubic yard of the mixture.

3. Imported Fill Material: Imported fill material shall be a granular material with sufficient binder to form a firm and stable unyielding subgrade and shall not have more than 60 percent of fines passing a 200 mesh sieve. Material shall provide a coefficient of expansion of not more than two percent from air dry to optimum moisture content and not more than six percent from air dry to saturation. Imported materials shall be clean and free of rubbish, debris, and toxic or hazardous contaminants. Adobe or clay soils are not permitted.

PART 3 - EXECUTION

3.01 GENERAL

A. Before initiating intrusive activities, contact Underground Service Alert of Southern California (USA or Dig Alert) to obtain a Dig Alert ticket for location information on buried

public and USA member utilities and pipelines at least 48-hours prior to beginning work. A copy of the Dig Alert ticket shall be forwarded to the OWNER. For on-site utilities, retain a state-licensed third party underground utility locating service.

B. Barricade trenches, ditches, pits, sumps, and similar Work outside the barricaded working area with chain link fence as specified in Section 01 5000, Construction Facilities and Temporary Controls, and in accordance with Cal-OSHA standards and requirements.

C. Saw-cut concrete or bituminous paving for trench installation.

D. Trenches over 5 feet in depth shall conform to the Cal-OSHA.

E. Where indicated and required to excavate in lawn areas, protect adjoining lawn areas outside of the Work area. Replace or install removed sod upon completion of backfill by installing sod level with adjacent lawns. If installation of removed sod fails, furnish sod and install to match existing lawns.

F. Backfill over excavations to the required elevations with earth, gravel, sand, or concrete and compact as required. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. Slope adjacent grades away from excavations to minimize entry of water.

G. Do not install piping lengthwise under concrete walks without review by the ARCHITECT.

H. Do not excavate trenches parallel to footings closer than 18 inches from the face of the footing or below a plane having a downward slope of two horizontal to one vertical, from a line 9 inches above bottom of footings.

1. Unless otherwise indicated on Drawings, depth of excavations outside the buildings shall allow for a minimum coverage above top of pipe, tank, or conduit measured from the lowest adjoining finished grade, as follows:

Steel Pipe	24 inches below finished grade
Copper Water Tube	18 inches below finished grade
Cast-Iron Pressure Pipe	36 inches below finished grade
Plastic Pipe (other than waste)	30 inches below finished grade
Tanks or other structures	36 inches below finished grade
Soil, Sewer & Storm Drain	minimum 18 inches below finished grade, and as required for proper pitch and traffic load. (Install polypropylene sewer pipe with at least 24 inches coverage)
Irrigation Pipe:	nonpressure pipe 12 inches, pressure pipe 24 inches

2. Trench width shall provide ample space for fitting and joining. Excavate for piping bells and fittings, bell and spigot pipe and other fittings.

I. Unless indicated otherwise, excavate trenches to the required depths for utilities, such as pipes, conduit and tanks, with minimum allowances of 6 inches at the bottom and 6 inches at the sides for bedding of unprotected piping or as required for concrete encasement of conduits as indicated on Drawings. Grade bottom of trenches to a uniform smooth surface. Remove loose soil from the excavation before installing sand bedding or concrete encasement.

J. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. If soil becomes soft, soggy, or saturated, excavate to firm undisturbed soil and fill as required. Slope adjacent grades away from excavations to minimize entry of water.

K. Provide a minimum clear dimension of 2 inches from sides of wall excavation to outer surfaces of buried pipes or conduits installed in the same trench or outside surfaces of containers and tanks.

L. Do not install backfill until required inspections and testing is completed.

M. Backfill electrical or other excavated utility trenches located outside of barricaded installation areas within 24 hours after inspection by the Project Inspector.

N. Install backfill materials in layers not exceeding 4 inches in thickness and compact to 90 percent of the maximum density.

O. If materials excavated from the Project site are not permitted for trench backfill in paved areas, backfill trenches with a cement-sand slurry mix. Install backfill to an elevation of the existing undisturbed grade plus one inch.

P. Install and compact sand bedding to provide a uniform full length bearing under piping and conduits.

Q. Where portions of existing structures, walks, paving, or other improvements are removed or cut for piping or conduit installation, replace the material with equal quality, finished to match adjoining existing improvements. Repair pavement as specified in Section 32 0117, Pavement Repair.

3.02 IMPORT/EXPORT OF MATERIALS

A. Provide fill materials as specified in Part 2, Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.

B. Imported fill materials will be sampled by the Geotechnical Engineer for compliance with the requirements of Part 2 of this Section.

D. The Geotechnical Engineer will perform the tests by utilizing an independent approved testing laboratory.

E. Initial sampling will be performed by the Geotechnical Engineer before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and/or entity responsible for the source site. The Geotechnical Engineer will obtain both the initial sample and additional samples from the identified site and shall submit all samples to the approved independent testing laboratory.

F. The Geotechnical Engineer will perform additional sampling during import operations. If the total quantity of import is determined to be greater than 1,000 cubic yards of material, one sample shall be obtained and submitted for testing for each 250 cubic yards of imported material. If the total quantity of import is determined to be less than 1,000 yards, one sample shall be obtained and submitted for testing for each 100 cubic yards of imported material.

G. The independent approved testing laboratory will perform the required tests and report results of all tests noting if the tested material passed or failed such tests and will furnish copies to the Project Inspector, ARCHITECT, OAR, DSA, CONTRACTOR, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, CBC and the DSA. Upon completion of the Work of this Section, the independent testing laboratory and Geotechnical Engineer will submit a verified report to the DSA as required by CBC.

H. Bills of lading or equivalent documentation will be submitted to the Project Inspector on a daily basis.

I. Upon completion of import operations, provide the OAR a certification statement attesting that imported material has been obtained from the identified source site.

3.03 INSPECTION AND TESTING

A. The Geotechnical Engineer will inspect and test excavations, sample material quality as required in Part 2, observe installation and compaction of fill materials.

B. Compaction test shall be performed in accordance with ASTM D1557, method "C."

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.

END OF SECTION

SECTION 32 0113

ROLLED SLURRY SEAL, EXISTING PAVEMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Asphalt emulsion slurry seal as indicated.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 32 0117 - Pavement Repair.

1.02 SUBMITTALS

A. Shop Drawings: Submit plan indicating extent of areas to be sealed.

B. Product Data: Submit mix design.

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction, current edition.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Slurry Seal: Provide the following material grades in accordance with Section 203 - Bituminous Materials of the Standard Specification for Public Works Construction, current edition.

1. Emulsified asphalt shall be slow set type grade CSS-1h.

2. Grading of the combined aggregate and percentage of emulsified asphalt shall conform to Type I slurry requirements.

3. Installed slurry seal shall be sufficiently cured to permit vehicle traffic within one day after application.

PART 3 - EXECUTION

3.01 REPAIRING AND ROLLED SLURRY SEAL EXISTING SURFACES

A. Preparation of Surfaces:

1. Before starting slurry seal operations, existing bituminous surfacing shall be cleaned of loose material, oil spots, vegetation, and other objectionable material.

2. Dampen surface to receive slurry seal with a light application of water to ensure coverage and proper bond.

3. Provide adequate protection over manholes, yard boxes, utility vaults and other improvements adjacent to the areas to receive slurry seal. Project Inspector shall inspect surfaces before the installation of slurry seal.

B. Repair of Existing Surfacing: Cracks more than ½ inch wide, low areas, holes or depressions in existing surfacing shall be repaired as specified in Section 32 0117: Asphalt Pavement Repair, prior to the installation of slurry seal.

C. Rolled Slurry Seal: Work shall be performed in accordance to Sub-section 302-4, Slurry, of the Standard Specifications for Public Works Construction, current edition.

1. Roll slurry surfacing with a 10-ton pneumatic roller with a tire pressure of 50 psi and equipped with a water spray system. Roll as soon as the surfacing is sufficiently cured and will not pick up on tires of roller. Surfaced areas shall receive a minimum of two coverage passes by roller. Provide a smooth surface free from ridges or surface variations.

2. Depressions occurring in cracks after initial slurry seal installation shall be filled with sand slurry before rolling and seal coat installation.

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 32 0117

ASPHALT PAVEMENT REPAIR

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Bituminous Surfacing Repair: Areas removed for utility trenches, heaved by tree roots, cracked areas, protruding areas where pavement meets hard surfaces, depressed areas, holes and areas around new structures, and raveled bituminous pavement.

2. Areas heaved by tree roots, cracked areas, holes and trenches, and areas around new structures.

B. Related Sections:

1. Division 01 - General Requirements.

2. Section 31 2323 - Excavation and Fill for Utilities.

3. Section 32 0113 - Rolled Slurry Seal, Existing Pavement.

4. Section 32 1216 - Asphalt Paving.

5. Section 32 1313 - Site Concrete Work.

6. Section 32 1236 - Seal for Bituminous Surfacing.

1.02 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings indicating areas to be repaired.

B. Product Data: Submit manufacturer’s technical data for materials and products.

1.03 QUALITY ASSURANCE

A. Comply with Standard Specifications for Public Works Construction, current edition.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Base course materials: Section 31 2326 - Base Course.

B. Asphalt paving materials: Section 32 1216 - Asphalt Paving.

C. Seal materials: Section 32 1236 - Seal for Bituminous Surfacing.

D. Headers: Section 32 1216 - Asphalt Paving.

2.02 BITUMINOUS MATERIALS

A. Provide materials and products of the class, grade or type indicated, conforming to relevant provisions of Section 203 - Bituminous Materials of the latest Standard Specifications for Public Works Construction.

PART 3 - EXECUTION

3.01 PAVEMENT REMOVAL

A. Remove bituminous and concrete pavement in accordance with applicable provisions of Section 300 - Earthwork of the Standard Specifications for Public Works Construction.

B. Pavement Heaved By Roots: Remove pavement to limits of distortion and expose roots. Trim roots to provide at least 12-inch clearance to pavement.

C. Remove protruding bituminous surfaces flush with the surrounding grade using a suitable tool or equipment so that adjacent finishes are not blackened.

D. Remove raveled and depressed bituminous pavement to limits indicated or required.

E. Saw cut existing improvements, trim holes and trenches in bituminous and concrete pavement to permit mechanical hand tampers to compact the fill.

F. Remove broken concrete by saw cutting. If the required cut line is within 30 inches of a score or joint line or edge, cut and remove to the score, joint line, or edge.

3.02 EXCAVATING, BACKFILLING AND COMPACTING

A. Conform to requirements in Section 31 2323 - Excavation and Fill for Utilities, as required.

B. Where subgrade or base is deemed to be unstable or otherwise unsuitable, excavate such materials to firm earth, and replace with a required material. Install and compact fill materials in accordance with the requirements of related Specification sections.

3.03 HEADERS

A. Install headers along edge of bituminous surfacing abutting turf, earth, or planting area, unless indicated otherwise.

B. Install headers so the bottom surface has continuous bearing on solid grade. Where excavation for headers is undercut, thoroughly tamp soil under the header. Compact backfill on both sides of header to the density of the adjacent undisturbed grade.

C. Fasten headers in place with redwood or Douglas fir stakes of length necessary to extend into solid earth a minimum of 12 inches. Stakes shall be of sound material, neatly pointed, driven vertically, and securely nailed to headers. Space stakes, not to exceed 4 feet on centers with top of stakes set one inch below top of header. Provide a minimum of two 12d galvanized common nails through each stake.

D. Remove existing headers where new surfacing is installed adjacent to existing surfacing.

E. Install temporary headers at transverse joints of paving where continuous paving operations are not maintained.

F. Provide additional stakes and devices as required to fasten headers.

3.04 BASE COURSE

A. Unless otherwise indicated, base course shall be crushed aggregate base, fine grade, 3 inches thick or equal to thickness of the existing base, whichever is greater.

3.05 RESURFACING

A. Holes and Trenches: Remove loose dirt and backfill with cement-sand slurry allowing for surfacing one inch thicker than existing. Resurface flush with existing adjoining pavement installing the same type of materials and section provided in existing improvements.

B. Other Areas: Other surface improvements damaged or removed shall be cut to a neat even line and excavated one inch below the bottom of the existing pavement. Resurface by following the original grades and installing the same type of materials provided in existing improvements.

C. Where bituminous surfacing abuts concrete, masonry, walks or paving, tamp joint smooth, if necessary, as described above to obtain a uniformly even joint, true to line and grade. Tamp and smooth materials before asphalt cools.

3.06 REPAIRING AND RESEALING EXISTING SURFACES

A. Preparation of Surfaces: Prior to filling cracks, clean existing bituminous surfacing of loose and foreign materials and coat with a film of asphalt emulsion.

B. Repair of Existing Surfacing:

1. Fill cracks ½ inch wide and less with RS-1 emulsion and silica sand or other required material. Cracks larger than ½ inch wide shall be filled with Type C2 Asphalt Concrete as specified. Cracks shall be filled to the level of adjacent surfacing.

2. Where low areas, holes, or depressions occur in existing surfacing, repair with emulsified asphalt. Install material, strike off the emulsified asphalt with a straightedge flush with adjoining surfacing. Finish with a steel trowel, and after dehydration, compact by rolling or tamping.

C. Testing: Flood test entire area in presence of the Project Inspector. Entire area tested shall be free of standing water or puddles.

D. Surface Seal: After surface has been repaired and tested, install seal coat over entire area indicated. Surface seal shall be as specified in Section 32 1236 - Seal For Bituminous Surfacing.

3.07 CLEANING

A. Remove all stains on the Project site and adjacent properties caused by or attributed to the Work of this section.

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

3.08 PROTECTION

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

END OF SECTION

SECTION 32 1216

ASPHALT PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Paving for playground, parking areas, areas between buildings, synthetic track surfacing adjacent to planting and turf areas as indicated.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 32 0117 - Pavement Repair.

3. Section 31 2326 - Base Course.

4. Section 32 1236 - Seal for Bituminous Surfacing.

5. Section 32 1313 - Site Concrete Work.

1.02 SUBMITTALS

A. Shop Drawings: Submit site plan indicating extent of paving and accessories.

B. Product Data: Manufacturer’s technical data for materials and products.

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction.

1.04 PROJECT CONDITIONS

A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

B A copy of the soils report is available for examination in the office of the Architect during regular office hours of the Architect.

PART 2 - PRODUCTS

2.01 BITUMINOUS MATERIALS

A. Provide materials of the class, grade, or type indicated on the Drawings, conforming to relevant provisions of Section 203 - Bituminous Materials of the Standard Specifications for Public Works Construction.

2.02 HEADERS

A. Concrete: Per specification Section 32 1313 - Site Concrete Work.

B. Wood:

1. Redwood, Construction Heart Grade, size 2 by 6, unless otherwise indicated.

2. Stakes: 2 by 4 redwood or 2 by 3 Douglas fir, Construction Grade.

3. Nails: Common, galvanized, 12d minimum.

PART 3 - EXECUTION

3.01 HEADERS

A. Install headers along edge of bituminous surfacing abutting turf, earth, or planting area, unless indicated otherwise.

B. Install headers so the bottom surface has continuous bearing on solid grade. Where excavation for headers is undercut, thoroughly tamp soil under the header. Compact backfill on both sides of header to the density of adjacent undisturbed earth.

C. Where wood headers are indicated on drawing, fasten headers in place with redwood or Douglas fir stakes of length necessary to extend into solid grade a minimum of 12 inches. Stakes shall be of sound material, neatly pointed, driven vertically, and securely nailed to headers. Space stakes, not to exceed 4 feet on center with top of stakes set one inch below top of header. Provide a minimum of two 12d galvanized common nails through each stake.

D. Remove existing headers where new surfacing is installed adjacent to existing surfacing.

E. Install temporary headers at transverse joints of paving where continuous paving operations are not maintained.

F. Provide additional stakes and anchorage as required to fasten headers in place.

3.02 CONSTRUCTION OF ASPHALT CONCRETE PAVEMENT

A. Thickness of Surfacing: Unless otherwise indicated on Drawings or specified, install bituminous surfacing to a compacted thickness of 2 inches.

B. Provide surfacing material over base course as specified in Section 31 2326 - Base Course.

C. Surfaces of walls, concrete, masonry, or existing bituminous surfacing indicated to be in direct contact with installed bituminous surfacing shall be cleaned, dried and uniformly coated with an asphaltic emulsion film.

D. Thicken edges of bituminous surfacing that do not abut walls, concrete, or masonry, and edges joining existing bituminous surfaces. Remove headers at existing bituminous surfacing where new bituminous surfacing is to be installed. Thicken edges an additional 2 inches and taper to the indicated or specified thickness 6 inches back from such edges.

E. At stairways, adjust thickness of paving such that the first tread is equal in height to all other treads.

F. Provide adequate protection for concrete, planting areas, and other finish Work adjacent to areas indicated to receive bituminous surfacing.

G. Placing:

1. Do not install bituminous surfacing when atmospheric temperature is below 40 degrees F; or when fog or other unsuitable weather conditions are present. Temperature of mixture at time of installation shall not be lower than 260 degrees F in warm weather or higher than 320 degrees F in cold weather.

2. Where 2-inch or 3-inch thick surfacing is indicated or specified, install surfacing in one course. Where surfacing is indicated or specified 4 inches or more in thickness, except for thickened edges, install bituminous surfacing in courses of approximately equal thickness, each course not exceeding 2 ½ inches in thickness.

H. Stakes or Screeds: Provide grade or screed stakes spaced not more than 15 feet apart in flow lines with grades of less than one percent. Continuous screeds may be provided instead of stakes.

I. Spreading: Install bituminous surfacing in a manner to cause least possible handling of mixture. In open areas and wherever practicable, install by mechanical means with a self-propelled mechanical spreader. In confined or restricted areas, install mixture with hot shovels and rakes, and smooth with lutes.

J. Joints: Provide vertical joints between successive runs. Install joints true to line, grade, and cross section. Lapped joints are not permitted.

K. Rolling:

1. Finish roll with a self-propelled tandem roller weighing at least 8 tons. Break down roll with a self-propelled roller weighing between 1 ½ tons and 8 tons.

2. Roll in a manner that preserves flow lines and the established finished grades. Break down roll in areas adjacent to flow lines parallel to flow lines. Break down roll after bituminous surfacing is installed without shoving or cracking of mixture under roller. Continue finish rolling until surfacing is unyielding, true to grade, and meets requirements for specified smoothness. Areas inaccessible to finish roller may be

finish rolled with breakdown roller or tamped with hot tamping irons and smoothed with hot smoothing irons or hand roller.

3. Where bituminous surfacing abuts concrete, masonry, walks or paving, tamp joint smooth, if necessary, as described above to obtain a uniformly even joint, true to line and grade. Tamp and smooth to properly compact.

4. Compacted bituminous surfacing shall be provided with a bulk specific gravity of at least 2.31 when tested in accordance with ASTM D1188.

3.03 TOLERANCE

A. Smoothness: Surface of bituminous surfacing after rolling, shall be even, smooth and uniform in texture with no voids or rock pockets, free of roller marks or other irregularities, and not varying by more than 0.03 foot, except at local depressions or raised areas as indicated, when a 10-foot straightedge is placed on surface.

B. Grade: Finished grade shall not vary more than 0.02 foot above or below required grade. Variations within prescribed tolerance shall be compensating so that average grade and cross-section are provided.

C. Premium paving tolerances and requirements for synthetic track:

1. General: Test in-place asphalt concrete courses for compliance with requirements or thickness and surface smoothness. Repair or remove and replace unacceptable paving as directed by Owner's representative.

2. Thickness: Tolerances for thickness shall be ¼ inch, plus or minus.

3. Planarity: The asphalt substrate shall not vary from the planned cross slope by more than plus or minus 0.1 percent. The finished asphalt shall not vary, plus or minus, under a 10 feet straight edge greater than 1/8 inch. Flood test the surface with the use of a water truck. If, after 30 minutes on a 70 degree F day, "bird baths" are evident at a depth more than 1/8 inch repair using the best method of correction.

4. Corrective Measures: Determine if the planarity, cross slopes, and general specifications have been met. If all of the conditions have been met notify the Owner in writing of the acceptance of the asphalt paving. [This notification must include the acceptance of the paving by the track surfacing contractor.]

5. No slurry or fog seals are to be applied to areas of asphalt paving that are to receive synthetic track surfacing.

3.04 TESTING

A. After first coat of surface seal has been installed and after a 24 hour period, the flood test shall be completed of the bituminous surfacing in presence of the Project Inspector. Repair areas of standing water or puddles and flood test locally; install surface seal and retest as necessary.

3.05 SURFACE SEALING

A. After bituminous surfacing has passed flood test, clear and allow to dry and provide one more coat of surface seal as specified in Section 32 1236 - Seal for Bituminous Surfacing.

B. Where indicated, provide multiple coats of surface seal to existing bituminous surfacing.

C. Where new bituminous surfacing joins existing bituminous surfacing, overlap surface seal a minimum of 12 inches onto existing bituminous surfacing.

3.06 PROTECTION

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

3.07 CLEANUP

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

END OF SECTION

SECTION 32 1236

SEAL FOR BITUMINOUS SURFACING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Surface sealer over bituminous surfacing.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 32 0117 - Pavement Repair.

3. Section 32 1216 - Asphalt Paving.

4. Section 32 1723 - Pavement Marking.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's product information and application procedures for bituminous surfacing.

1.03 QUALITY ASSURANCE

A. Comply with the Standard Specifications For Public Works Construction, current edition.

B. Agitate bulk materials during transport.

1.04 MAINTENANCE

A. Extra Materials: Provide 10 gallons in unopened containers.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide one of the following surface seals:

	Product Name	Manufacturer
1.	Guard-Top	CALMAT / Industrial Asphalt

2.	Over Kote	Diversified Asphalt Product
3.	Park Top	Western Colloid Products
4.	Sure Seal	Asphalt Coating Engineering
5.	Super Drive Top.	SAF– T Seal. Inc.
6.	Equal.	

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. Thoroughly wash surfaces with water to remove dirt, debris, excessive oil and grease, or other foreign matter.

3.02 APPLICATION

A. Install seal coat in strict accordance with manufacturer's written directions and recommendations.

B. Install two coats of surface seal to new bituminous surfacing. First coat shall be installed before flood testing. Clean surface and allow to dry before installing second coat. Second coat shall be installed after bituminous surfacing has passed flood test.

C. Where new bituminous surfacing is installed adjacent to existing bituminous surfacing, overlap surface seal a minimum of 12 inches onto existing bituminous surfacing.

D. Where existing bituminous surfacing is indicated to be patched and sealed, install two coats of surface seal after patching. Refer to Section 32 1216 - Asphalt Paving.

3.03 PROTECTION OF SURFACES

A. Protect sealed and unsealed surfaces from damage and traffic during performance of the Work of this section and until surface seal has thoroughly set and cured. Do not permit traffic of any kind for at least 24 hours after completion of installation.

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

3.04 TESTING

A. Owner reserves the right to obtain samples, perform tests to ensure compliance with the Specifications, and to review weight slips and invoices of materials delivered to the Project site.

3.05 CLEAN UP

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

END OF SECTION

SECTION 32 1313

SITE CONCRETE WORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: On-site concrete work:

1. Portland cement concrete pavement, driveways, curbs, gutters and mowing strips.

2. Ramps and stairs on grade.

3. Footings for fence posts, bollards, flagpoles, shade structures, light standards and athletic and playground equipment.

4. Pipe encasements, thrust blocks, and equipment pads.

5. Retaining walls, planter walls and concrete benches.

6. Skateboard deterrents.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 03 1000 – Concrete Forming and Accessories.

3. Section 03 2000 - Concrete Reinforcement.

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

5. Section 07 9200 – Joint Sealants.

6. Division 23 - HVAC.

7. Division 26 - Electrical.

8. Section 31 2200 – Grading.

9. Section 32 1216 - Asphalt Paving.

10. Section 32 1723 – Pavement Markings.

1.02 REFERENCES

A. Structural work, such as retaining walls, planter walls, cast-in-place benches, equipment pads, and footings for playground equipment, fences, walls, shade structures and flagpoles shall conform to the following Sections:

1. Section 03 1000 Concrete Forming.

2. Section 03 2000 Concrete Reinforcing.

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

B. Flatwork, such as walkways, driveways, ramps and steps on grade, swales, curbs, mow strips and utility related concrete, conform to:

1. Standard Specifications for Public Works Construction, The “Greenbook”, except reclaimed aggregates and processed miscellaneous base are not allowed.

C. National Ready Mixed Concrete Association (NRMCA):

1. Checklist for the Concrete Pre-Construction Conference.

1.03 QUALITY ASSURANCE

A. Source Limitations for Exposed Concrete: Obtain each color, size, type, and variety of concrete material and concrete mixture from single manufacturer with resources to provide concrete of consistent quality in appearance and physical properties. Secure material required for the duration of the project as needed to ensure consistent quality in appearance.

B. Pre-Installation Conference:

1. CONTRACTOR shall coordinate and conduct pre-installation conference in conformance to Section 01 3119 Project Meetings.

2. CONTRACTOR shall use the NRMCA “Checklist for the Concrete Pre-Construction Conference” as the meeting agenda.

C. Mockup:

1. Build 8 feet by 8 feet mockups of full-thickness sections of concrete paving using processes and techniques intended for use on permanent work, including curing procedures.

2. Build mockups to demonstrate typical joints; surface finishes and standard of workmanship.

3. Obtain ARCHITECT’s approval of mockup before proceeding with work of this Section.

4. Mockup shall remain through completion of the work for use as a quality standard for finished work.

5. Remove mockup when directed by the OAR.

D. Field applied primers, paintings, sealers, sealants, caulking, leveling and patching compounds, crack/joint repair compounds adhesives and similar products shall be approved by the OWNER's Office of Environmental Health and Safety (OEHS).

1.04 SUBMITTALS

A. Structural Work: Conform to the applicable requirements of Sections 03 1000 Concrete Forming, 03 2000 Concrete Reinforcing and 03 3000 Cast-in-Place Concrete.

B. Flatwork: Submit mix design in conformance to the Greenbook.

C. Shop Drawings: Submit drawings indicating the locations of concrete joints, including construction joints, expansion joints, isolation joints, and contraction joints.

D. Submit concrete Sample of each specified color.

E. Submit full range of manufacturer's standard and custom range colors and products for ARCHITECT's review and selection.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store cement and aggregate materials so to prevent their deterioration or intrusion by foreign matter. Deteriorated or contaminated materials shall not be furnished.

B. Packaged materials shall bear the manufacturers and brand name label and shall be stored in their original unbroken package in a weather tight place until ready for use in the work.

C. Avoid exposure of reinforcing steel bars, wire, and wire fabric to dirt, moisture or conditions harmful to reinforcing.

D. Reinforcing steel bars, wire, and wire fabric shall be stored on the Project site to permit easy access for examination and identification of each shipment. Material of each shipment shall be separated by size and shape.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Structural Work: Conform to the applicable requirements of the following Sections, except as otherwise specified:

1. Section 03 1000 Concrete Forming.

2. Section 03 2000 Concrete Reinforcing.

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

4. Section 07 9200 Joint Sealants.

B. Flatwork: Conform to the applicable requirements of the Greenbook, Section 201, except as follows:

1. Water/cement ration for concrete flatwork shall be 0.50 maximum.

2. Base course shall conform to Section 32 3226 Base Course.

3. Reclaimed concrete material shall not be used.

2.02 SKATEBOARD DETERRENTS

A. Manufacturer: Barrett Robinson Inc. or equal.

B. Fabricated from 6061-T6 aluminum, clear anodized.

1. Fixed Angle Series:

a. FR0.12: For walls with 1/8" radius edge. Dimensions: 4.875" top x 1.0" face x 2.0" wide.

b. FA90A: For walls with 1/8" radius edge. Dimensions: 4.0" top x 2.375" face x 2.0" wide.

c. FA135: For chamfered edges, where the chamfer is 3/4” or more. Dimensions: 2" wide X 3-1/2" long X 1-1/8" tall.

d. FA902.5: For 90 degree walls with 1/2" radius edge. Dimensions: 3.75" top x 2.375" face x 2.0" wide.

2. Fixed Radius:

a. FR.12: For 1/8" radiused edges. Dimensions: 4.875" top x 1.0" face x 2.0" wide.

b. FR.05: For 1/2" radiused edges. Dimensions: 3.75" top x 1.0" face x 2.0" wide.

c. FR1.0: For 1" radiused edges. Dimensions: 4.375" top x 1.625" face x 2.0" wide.

3. Gorilla Series:

a. Gorilla 012: Rounded edge. For square corners from 0” - 3/8” radius. Size: 1-1/8” wide x 8” deep x 1-1/8”.

b. Gorilla 0135: Chamfered edge. For square corners from 0” - 3/8” radius. Size: 1-1/8” wide x 8” deep x 1-1/8”.

4. Two-part epoxy adhesive shall be approved by the OWNER’s Office of Environmental Health and Safety (OEHS).

5. Fastening pins as recommended by skateboard deterrent manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that gradients and elevations of base are correct. Maintain subgrade clean and in a smooth, compacted condition until the concrete is placed.

B. Maintain subgrade in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. Earth surface shall be kept moist by frequent sprinkling up to the time of placing concrete.

3.02 CONSTRUCTION OF FORMS

A. Flatwork Forming: Set forms to the indicated alignment, grade and dimensions. Hold forms rigidly in place by a minimum of 4 stakes per form placed at intervals not to exceed two feet. Use additional stakes and braces at corners, deep sections, and radius bends, as required. Use clamps, spreaders, and braces where required to ensure rigidity in the forms.

B. Wall Formwork: Forms shall be constructed to conform to final concrete shape, lines and dimensions of members required by Drawings and Specifications. Forms shall be sufficiently tight to prevent leakage of concrete and properly braced or tied together to maintain position and shape.

3.03 STEEL REINFORCEMENT INSTALLATION

A. Fabricate bars of the indicated sizes and bend and form to required shapes and lengths by methods not injurious to materials. Do not heat reinforcement for bending. Bend bars No. 6 size and larger in the shop only. Bars with unscheduled kinks or bends are not permitted.

B. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

C. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces, and lace splices with wire.

D. Clean reinforcement of loose rust and mill scale, earth, or bond-reducing materials.

3.04 PREPARATION FOR CONCRETE PLACEMENT

A. Surfaces to receive concrete shall be free of debris, standing water, and any other deleterious substances before start of concrete placing.

B. Do not place concrete until forms, reinforcement, pipe, conduits, outlet boxes, anchors, sleeves, bolts, and other embedded materials are securely fastened in place. Maintain a minimum of two inches clearance between said items and any part of the concrete reinforcement.

C. Adjust pull boxes, meter boxes, valve covers and manholes to proposed finish grade prior to placement of concrete. Anchor bolts shall be accurately set and maintained in position by templates while being embedded in concrete.

D. Clean thoroughly the surfaces of metalwork to be in contact with concrete, remove dirt, grease, loose scale and rust, grout, mortar, and other foreign substances before the concrete is placed.

E. Moisten subbase to provide a uniform dampened condition at time concrete is placed.

3.05 CONCRETE PLACEMENT

A. Place, compact, screed, float and trowel concrete as indicated in Section 03 3000 Cast-in-Place Concrete.

B. Finish: After straightedging, when most of the water sheen has disappeared and just before the concrete hardens, finish the surface with a wood or magnesium float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. Produce a scored surface by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, followed by edging.

1. Provide medium broom finish on surfaces up to six percent slope by striating surface 1/32 to 3/64 inch deep with a soft bristle broom across concrete surface to provide a uniform fine line texture.

2. Provide heavy broom finish on surfaces over six percent by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom.

3.06 JOINTS

A. Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated. Align curb, gutter, and sidewalk joints.

B. Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour.

1. Continue steel reinforcement across construction joints unless otherwise indicated on the Drawings.

2. Provide tie bars at sides of paving strips where indicated on the Drawings

3. Butt Joints: Use bonding agent or epoxy-bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

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

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated on the Drawings.

D. Expansion Joints:

1. Provide premolded joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together. Extend expansion joint fillers full-width and depth of joint, and 1/4" below finished surface where joint filler is indicated. If no joint sealer is indicated place top of premolded joint filler flush with top of concrete or curb.

2. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

E. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints to a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Remove grooving-tool marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

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

F. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Remove edging-tool marks on concrete surfaces.

G. Where concrete is to be cast against old concrete, (greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by sand-blasting, exposing the aggregate. The hardened surface shall be cleaned of latent foreign material and washed clean, prior to the application of an epoxy bonding agent.

3.07 STAIRS AND RAMPS

A. Install support post sleeves into the perimeter concrete curbing during the installation process of the curbing. Sleeves shall be three-inch diameter, schedule 40 PVC with a cap solvent welded to the bottom of the sleeve. Drill a half-inch weep hole on the bottom of the cap. Sleeve and cap shall be Nibco products or approved equal. Sleeves shall be embedded into concrete a minimum of nine inches and spaced at a maximum of four feet, or as indicated on the Drawings. Fill sleeve with non-shrink grout Quickcrete #1585-01 when setting posts. Provide control joints into the concrete on both sides for each post.

B. Finish step nosings with a safety step edger/groover with a 1/2 inch radius and four grooves spaced equally 3/4 inch on center and a bit depth between 1/4 to 3/8 inch. Paint with contrasting color.

3.08 CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING

A. Formed Curb and Gutter: Place concrete to the required section in a single lift. Consolidate concrete using approved mechanical vibrators. Finish curve shaped gutters with a standard curb mule or concrete slipformed curb paving equipment.

B. Concrete Finishing: Float and finish exposed surfaces with a smooth wood float until true to grade and section and uniform in texture. Brush floated surfaces with a fine-hair brush using longitudinal strokes. Round the edges of the gutter and top of the curb with an edging tool to a radius of 1/2 inch. Immediately after removing the front curb form, rub the face of the curb with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. Brush the front curb surface, while still wet, in the same manner as the gutter and curb top. Finish the top surface of gutter to grade with a wood float.

C. Surface and Thickness Tolerances: Finished surfaces shall not vary more than 1/4 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

3.09 CLEAN UP

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

3.10 PROTECTION

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

END OF SECTION

SECTION 32 1723

PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Playground markings.
2. Fire lane “No Parking.”
3. Curb marking and red curbs.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 32 1236 - Seal for Bituminous Surfacing.

1.02 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings, indicating location, extent, color and texture of markings.

B. Material Samples: Submit color Samples.

1.03 PROJECT CONDITIONS

A. Do not install markings when adverse weather conditions are forecasted.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Paint: Water emulsion-based traffic paint must be approved by OEHS (LAUSD’s Office of Environmental Health and Safety)

1. Dunn Edwards: Vin-L-Stripe.
2. Pervo Paint Company: Acrylic Traffic Paint.
3. Sherwin Williams: Setfast Acrylic Traffic Paint.
4. Vista Paint Corporation: Traffic Paint.
5. Equal.

PART 3 - EXECUTION

3.01 PAVEMENT MARKINGS

A. Application of Paint:

1. Prior to application of paint, allow the pavement to properly cure. Clean and prepare in accordance with paint manufacturer's written recommendations.

2. Provide mechanical equipment to apply paint in a uniform, straight or curved pattern, without gaps, holidays, runs, or other defects.

3. Do not permit traffic until paint has completely cured.

4. Apply two coats in thickness recommended by manufacturer.

5. Playground Markings: Submit Samples to Architect for review. Limited color palettes may be submitted.

B. Marking Width and Color: Unless indicated otherwise, marking width and color are as follows:

Location	Width	Color
Parking stall lines	4 inches	White
Traffic markings		
Striping:	4 inches	Yellow
General	4 inches	Yellow
Accessible Parking	4 inches	Blue
International Symbol of Accessibility (ISA)	2 inches	White on blue background
Athletic Court Lines:	2 inches	*White
Letters and numbers:		As indicated

*Where two sets of lines overlap, one set shall be white and the other set shall be yellow.

3.02 PROTECTION

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

3.03 CLEANUP

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

END OF SECTION

EXHIBIT “A”

SCOPE OF WORK

THIS SCOPE OF WORK OUTLINES THE GENERAL NATURE AND EXTENT OF THE WORK. OTHER PARTS OF THE BID DOCUMENTS, DRAWINGS AND SPECIFICATIONS MAY SHOW AND/OR REFERENCE WORK NOT SPECIFICALLY INCLUDED IN THESE NOTES.

- REMOVAL OF THE GYMNASIUM BUILDING "S" HEATING AND VENTILATION SYSTEMS AND FURNISH AND INSTALL NEW HVAC SYSTEM.
- FURNISH AND INSTALL NEW POWER FEEDER AND TRANSFORMER FOR THE GYMNASIUM BUILDING "S" HVAC SYSTEM INCLUDING UNDERGROUND PATHWAY.
- REMOVAL OF THE GIRLS LOCKER ROOM BUILDING "R" AND GYMNASIUM BUILDING "S" ROOFING AND FURNISH AND INSTALL NEW ROOFING AND SKYLIGHTS.
- REMOVAL OF THE GIRLS LOCKER ROOM BUILDING "R" AND GYMNASIUM BUILDING "S" BOYS LOCKER ROOM BUILDING "T" FIRE ALARM AND FURNISH AND INSTALL NEW FIRE ALARM SYSTEM.

Engineers Estimate:
We are carrying an estimate of $2,250,000.00

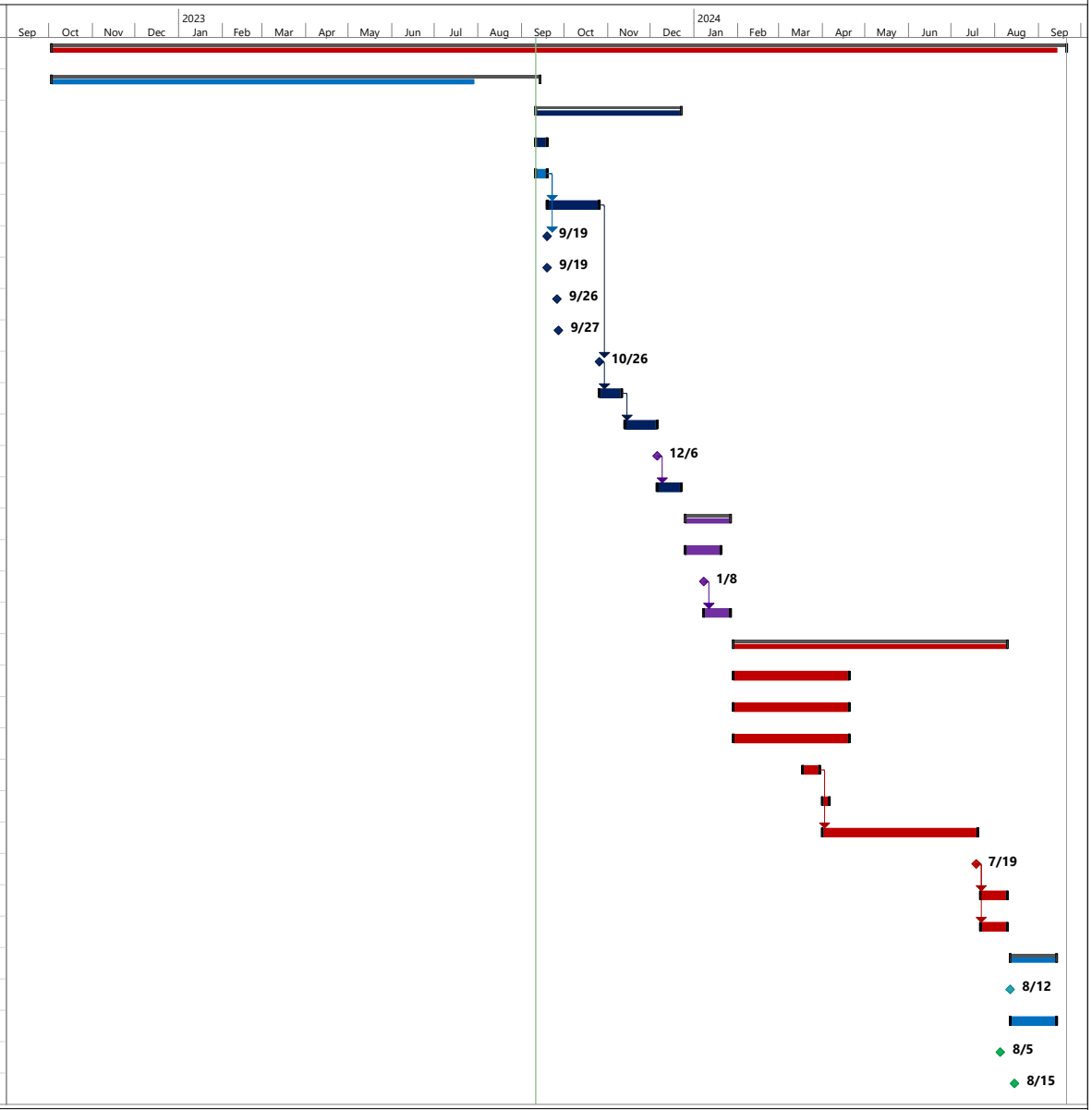
Contractor's License Requirement: B

EXHIBIT “B”

CONSTRUCTION SCHEDULE

ROSEMEAD HIGH SCHOOL
El Monte Union High School District
Gymnasium Air Conditioning
Project Schedule - December Award

ID	Task Name	Duration	Start	Finish
1	**Project Schedule**	**515 days**	**Mon 10/3/22**	**Fri 9/20/24**
2	**Design and Agency Approval**	**248 days**	**Mon 10/3/22**	**Wed 9/13/23**
16	**Bidding and Award**	**75 days**	**Mon 9/11/23**	**Fri 12/22/23**
17	Prepare Bid Solicitation	6 days	Mon 9/11/23	Mon 9/18/23
18	Prepare Bid Packages	6 days	Mon 9/11/23	Mon 9/18/23
19	Bidding	27 days	Tue 9/19/23	Wed 10/25/23
20	Issue Bid Documents / Load to EMUHSD Site	0 days	Tue 9/19/23	Tue 9/19/23
21	First Bid Advertisement	0 days	Tue 9/19/23	Tue 9/19/23
22	Second Bid Advertisement	0 days	Tue 9/26/23	Tue 9/26/23
23	Mandatory Job Walk	0 days	Wed 9/27/23	Wed 9/27/23
24	Bids Due / Bid Open	0 days	Thu 10/26/23	Thu 10/26/23
25	Review and Analysis of Bid	12 days	Thu 10/26/23	Fri 11/10/23
26	Recommendation to Board of Education	17 days	Mon 11/13/23	Tue 12/5/23
27	**Board Award of Project**	**0 days**	**Wed 12/6/23**	**Wed 12/6/23**
28	Enter Contracts with GC	13 days	Wed 12/6/23	Fri 12/22/23
29	**Preconstruction**	**24 days**	**Tue 12/26/23**	**Fri 1/26/24**
30	Preconstruction	19 days	Tue 12/26/23	Fri 1/19/24
31	**GC to Submit all Long Lead Items**	0 days	Mon 1/8/24	Mon 1/8/24
32	Submittal Review and Approval	15 days	Mon 1/8/24	Fri 1/26/24
33	**Construction - GC Activities**	**140 days**	**Mon 1/29/24**	**Fri 8/9/24**
34	GC Procure Roofing Materials	3 mons	Mon 1/29/24	Fri 4/19/24
35	GC Procure Electrical / Fire Alarm	3 mons	Mon 1/29/24	Fri 4/19/24
36	GC Procure HVAC Equipment	3 mons	Mon 1/29/24	Fri 4/19/24
37	GC Mobilization	10 days	Mon 3/18/24	Fri 3/29/24
38	**Spring Break**	**5 days**	**Mon 4/1/24**	**Fri 4/5/24**
39	GC Construction	80 days	Mon 4/1/24	Fri 7/19/24
40	GC Substantial Completion	0 days	Fri 7/19/24	Fri 7/19/24
41	GC Punch List	15 days	Mon 7/22/24	Fri 8/9/24
42	GC Training	15 days	Mon 7/22/24	Fri 8/9/24
43	**Project Turnover and Closeout**	**25 days**	**Mon 8/12/24**	**Fri 9/13/24**
44	Projct Turnover	0 days	Mon 8/12/24	Mon 8/12/24
45	Project and DSA Close Out	25 days	Mon 8/12/24	Fri 9/13/24
46	**Staff Return**	**0 days**	**Mon 8/5/24**	**Mon 8/5/24**
47	**First Day of School**	**0 days**	**Thu 8/15/24**	**Thu 8/15/24**



Project:
RHS Gym AC Project Schedule
Date: Mon 9/11/23

Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone

EXHIBIT “C”

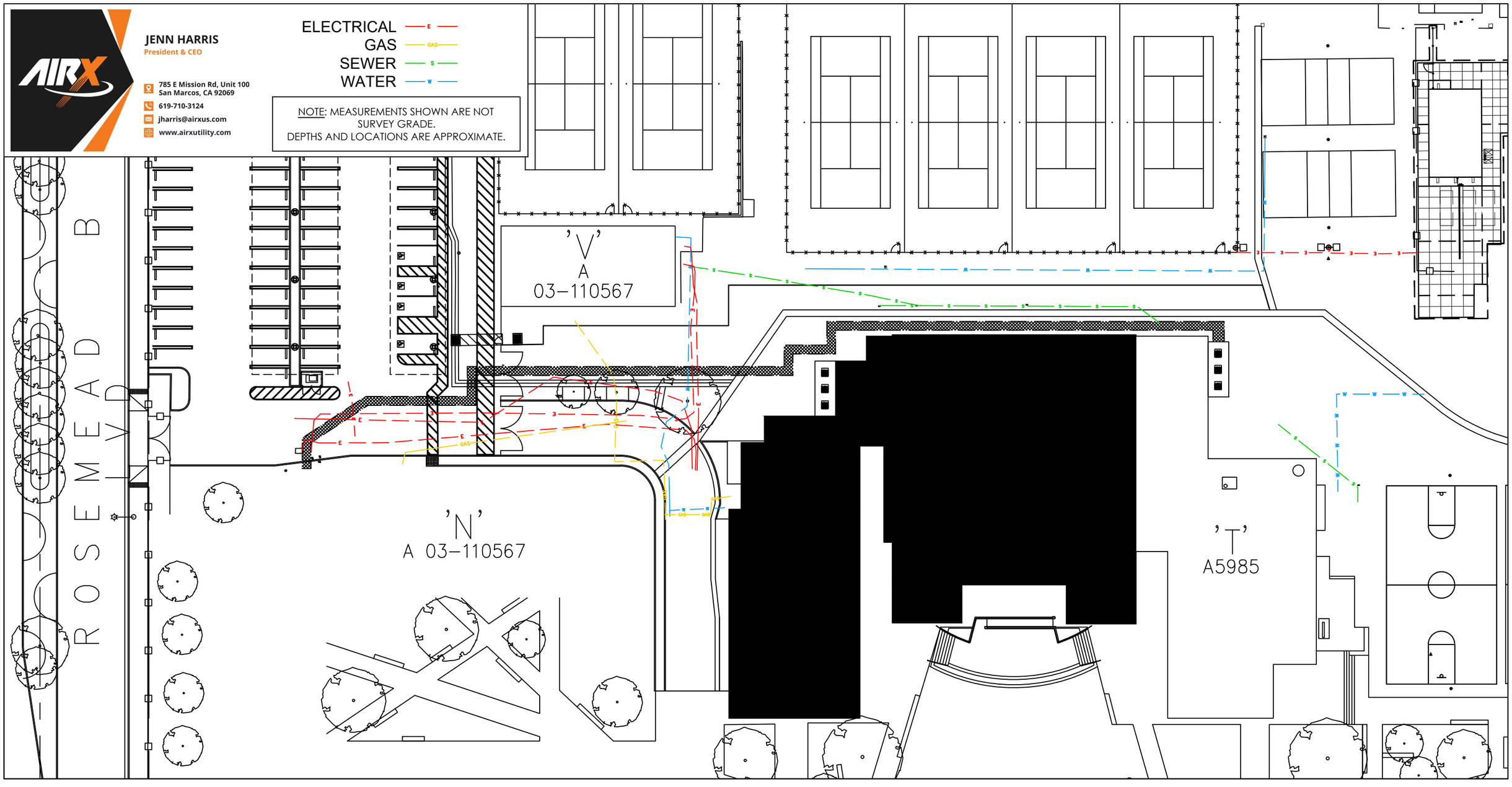
SITE UTILITY SURVEY

JENN HARRIS
President & CEO

785 E Mission Rd, Unit 100
San Marcos, CA 92069
619-710-3124
jharris@airxus.com
www.airxutility.com

ELECTRICAL — E
GAS — GAS
SEWER — S
WATER — W

NOTE: MEASUREMENTS SHOWN ARE NOT SURVEY GRADE.
DEPTHS AND LOCATIONS ARE APPROXIMATE.



JENN HARRIS
President & CEO

785 E Mission Rd, Unit 100
San Marcos, CA 92069
619-710-3124
jharris@airxus.com
www.airxutility.com

PROJECT NAME: RHS Gymnasium HVAC Project, Rosemead

AIRX JOB#: 23-174IE

THOMAS GRID#:

TYPE OF WORK: Utility Locating

DRAWN FOR: El Monte Union HSD

NOTES:

DATE: 7/20/2023

DESIGNED BY: Clinton Boogaard

SHEET 1 OF 1

EXHIBIT “D”

ASBESTOS AND LEAD SAMPLING REPORT

HAZTRAINER MULTINATIONAL INC. DBA
ENVIRONMENTAL ASSISTANCE GROUP
16835 ALGONQUIN ST. #412 HUNTINGTON BEACH CA 92649
PHONE: 949-237-1036 E-MAIL comply@haztrainer.com

REPORT
of
ASBESTOS and LEAD SAMPLING

Conducted at

EL MONTE UNION HIGH SCHOOL DISTRICT
ROSEMEAD HIGH SCHOOL GYMNASIUM
9063 E. MISSION DRIVE
ROSEMEAD, CALIFORNIA 91770

Prepared for

NORMA MACIAS, DIRECTOR OF
FACILITIES, MAINTENANCE, OPERATIONS AND TRANSPORTATION
EL MONTE UNION HIGH SCHOOL DISTRICT
1003 N. DURFEE AVENUE
SOUTH EL MONTE, CALIFORNIA 91733

Prepared by

ENVIRONMENTAL ASSISTANCE GROUP
16835 Algonquin St. #412
Huntington Beach Ca 92649

Project Number: EMR623

JUNE 2023

Report generated by

Eldwin “Ed” Kennedy, Certified Asbestos Consultant CAC# 93-1429
and Certified Lead Professional CLP# 4092
President
Environmental Assistance Group

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

I. EXECUTIVE SUMMARY

INTRODUCTION

On June 30th and July 7th, 2023, Environmental Assistance Group represented by and Perry Robey (CSST) and supervised Ed Kennedy (CAC) collected samples of suspect asbestos and lead containing materials for the El Monte Union High School District (EMUHSD). The sampling was requested by Andrew Ulmen of Huckabee-Inc and Tony Barrera, Maintenance Coordinator for EMUHSD. The samples were taken from the Gymnasium at Rosemead High School, 9063 E. Mission Drive Rosemead, CA 91770. Homogeneous areas of materials were identified and samples of suspect lead containing paint and potential asbestos containing materials were collected from the roof and from the inside to determine which materials might contain asbestos and lead and require specified work practices with asbestos and lead trained workers. Fifteen representative samples were collected of suspect asbestos (ACM) and seven representative samples were collected of suspect lead containing paint.

METHOD

A visual inspection of the building and roof was conducted to identify types of homogenous asbestos materials lead containing paint and where they are located. The suspected asbestos materials were cut out, scraped off, or broken off. The lead paint samples were scraped off. All samples were placed in leak tight containers and transported to a NVLAP and DHS certified laboratory, SGS Forensic Laboratories in Carson, CA, for analysis by polarized light microscopy (PLM). Analysis of the lead was accomplished by Flame Atomic Absorption (AA). A chain of custody was attached to the sample submittal sheets. After analysis, the results were provided for inclusion in this report.

RESULTS

The analyses showed that all asbestos samples except for one sample of pipe insulation contained 8% asbestos. All the rest were None Detected (ND) for asbestos. The lead samples collected and analyzed showed that four of the sampled materials contained lead greater than the LA County definition of lead-based-paint (LBP) at 0.06% lead by weight. The other three were below the level of detection or none detected (ND) for lead. Detailed tables included in this report describe the type and locations of sampled materials, whether they contain asbestos or lead.

RECOMMENDATIONS

If it will be disturbed, the pipe insulation in the Gym will need to be removed by a licensed Asbestos Abatement Contractor in accordance with an Asbestos Project Design prepared by a Certified Asbestos Consultant. No special handling of the sampled materials identified as none detected (ND) is required due to the absence of asbestos. OSHA requires personal airborne lead assessment for any detectable level of lead during disturbance. Under OSHA standards, disturbance of materials with any amount of lead requires the use of lead trained workers.

II. ASBESTOS HOMOGENEOUS AREA FORM

HOMOGENOUS AREA/SAMPLING FORM
ASBESTOS

Page 1 of 1

Environmental Assistance Group
16835 Algonquin St. Suite 412
Huntington Beach, CA 92649
Office: 949-237-1036

CLIENT: EMUHSD

DATE: 6-30-23 SITE: Rosemead High School

SAMPLED: 6-30-23 Gym Roof PROJECT # EMR623

INSPECTOR: Perry Robey Signature: CSST #: 22-7026

SUPERVISED BY: Eldwin "Ed" Kennedy Signature: CAC #: 93-1249

HA	SAMPLE #	HOMOGENOUS MATERIAL	CONDI-TION	LOCATION/ SURFACE	BLDG/ SUITE	RM/#	SAMPLE LOCATION	AMT
1	EMR623-1	Roll roofing w/ silver cap	Good		Gym roof	Roof area	3' from N. 3' from E.	ND
1	EMR623-2	Roll roofing w/ silver cap	Good	At cove	Gym roof	Roof area	20' from E. 23' from N.	ND
1	EMR623-3	Roll roofing w/ silver cap	Good	At valve penetration	Gym roof	Roof area	3' from N. 45' from W.	ND
1	EMR623-4	Roll roofing w/ silver cap	Good	At pipe penetration	Gym roof	Roof area	4' from W. 28' from N.	ND
1	EMR623-5	Roll roofing w/ silver cap	Good	Field	Gym roof	Roof area	50' from E. 50' from S.	ND
1	EMR623-6	Roll roofing w/ silver cap	Good	Field	Gym roof	Roof area	32' from E. 10' from S.	ND
2	EMR623-7	Roll roofing w/. silver & black patch	Good	At pipe penetration	Gym roof	Roof area	4' from E. 3' from S.	ND
2	EMR623-8	Roll roofing w/. silver & black patch	Good	Field	Gym roof	Roof area	3' from S. 50' from W.	ND

HOMOGENOUS AREA/SAMPLING FORM
ASBESTOS

Page 1 of 1

Environmental Assistance Group
16835 Algonquin St. Suite 412
Huntington Beach, CA 92649
Office: 949-237-1036

CLIENT: EMUHSD

DATE: 7-7-23 SITE: ROSEMEAD H.S.

SAMPLED: 7-7-23 GYM INTERIOR PROJECT # EMRM723

INSPECTOR: Perry Robey Signature: CSST #: 22-7026

SUPERVISED BY: Eldwin "Ed" Kennedy Signature: CERT/CAC #: 93-1249

HA	SAMPLE #	HOMOGENOUS MATERIAL	CONDI-TION	LOCATION/ SURFACE	BLDG/ SUITE	RM/#	SAMPLE LOCATION	AMT
1	EMRM723-1	Drywall panels	Good	2x3 panels over metal ceiling	Gym	Gym ceiling	45' from N. at ceiling	ND
1	EMRM723-2	Drywall panels	Good	2x3 panels over metal ceiling	Gym	Gym ceiling	40' from N. at ceiling	ND
2	EMRM723-3	Smooth wall plaster	Good	Walls	Gym	Gym walls	15' up on W. 40' from N.	ND
2	EMRM723-4	Smooth wall plaster	Good	Walls	Gym	Gym walls	15' up on W. 45' from N.	ND
3	EMRM723-5	2x6 wall panel – straight pin hole and fibrous material	Good	Panels on cement	Gym	Gym walls	18' up on W. 40' from N.	ND
3	EMRM723-6	2x6 wall panel – straight pin hole and fibrous material	Good	Panels on cement	Gym	Gym walls	18' up on W. 45' from N.	ND
4	EMRM723-7	Pipe insulation (TS)	Good	Along gym walls	Gym	Gym walls	(Up on all walls) 15' up on W. 40' from N.	8%

III. LEAD SAMPLING FORM

LEAD SAMPLING FORM

Page 1 of 1

Environmental Assistance Group
16835 Algonquin St. Suite 412
Huntington Beach, CA 92649
Office: 949-237-1036

CLIENT: EMUHSD

DATE: 7-7-23 SITE: ROSEMEAD H.S. PROJECT # EMRM723Pb

SAMPLED: 7-7-23

INSPECTOR: Perry Robey Signature: CCST #: 22-7026

SUPERVISED BY: Eldwin Kennedy Signature: LRC-00002679

SAMPLE #	HOMOGENOUS MATERIAL	CONDI-TION	LOCATION/ SURFACE	BLDG/ SUITE	RM/#	SAMPLE LOCATION	AMT wt.%
EMRM723Pb-1	White paint on cement wall	Good	Cement wall	Gym	Gym wall	10' from N. 8' up on E.	0.13
EMRM723Pb-2	White paint on cement wall	Good	N.E. corner	Gym	Gym wall	6' from N. 3' up on E.	0.18
EMRM723Pb-3	White paint on cement wall	Good	N.W. at girls R/Rs.	Gym	Hall	3' from N. 8' from W. 6" up on E.	0.13
EMRM723Pb-4	White paint on wood	Good	Wood on wall siding	Gym	Gym wall	30' from N. 3' up on W.	<0.006
EMRM723Pb-5	White paint on wood	Good	Wood on wall siding	Gym	Gym wall	30' from N. 3' up on E.	0.12
EMRM723Pb-6	White paint on smooth plaster	Good	Plaster wall	Gym	Gym wall	15' up on W. 40' from N.	0.006
EMRM723Pb-7	White paint on smooth plaster	Good	Plaster wall	Gym	Gym wall	15' up on W. 50' from N.	0.006
EMRM723Pb-8	Black paint on drywall	Good	Ceiling tile paint	Gym	Gym ceiling	45' from N. at ceiling	
EMRM723Pb-9	Black paint on drywall	Good	Ceiling tile paint	Gym	Gym ceiling	40' from N. at ceiling	

IV. ASBESTOS SAMPLING RESULTS REPORTS

SGS FORENSIC LABORATORIES

Final Report

Bulk Asbestos Analysis

(EPA Method 40CFR, Part 763, Appendix E to Subpart E and EPA 600/R-93-116, Visual Area Estimation)
NVLAP Lab Code: 101459-1

Environmental Assistance Group
Ed Kennedy
16835 Algonquin St.
#412
Huntington Beach, CA 92649

Client ID: L1206
Report Number: B349222
Date Received: 07/03/23
Date Analyzed: 07/06/23
Date Printed: 07/06/23
First Reported: 07/06/23

Job ID/Site: EMR623; Rosemead H.S; Gym Roof

Date(s) Collected: 06/30/2023

SGSFL Job ID: L1206
Total Samples Submitted: 9
Total Samples Analyzed: 9

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
EMR623-1	51673214						
Layer: Black Roof Shingle			**ND**				
Layer: Black Tars			**ND**				
Layer: Black Felts			**ND**				
Layer: Silver Paint			**ND**				
Layer: Black Tar			**ND**				
Layer: Black Felt			**ND**				
Layer: Silver Paint			**ND**				
Total Composite Values of Fibrous Components:		**Asbestos (ND)**					
Cellulose (Trace) Fibrous Glass (30 %)							
Comment: Bulk complex sample.							
EMR623-2	51673215						
Layer: Black Roof Shingle			**ND**				
Layer: Black Tars			**ND**				
Layer: Black Felts			**ND**				
Layer: Black Tar			**ND**				
Layer: Black Felt			**ND**				
Layer: Silver Paint			**ND**				
Total Composite Values of Fibrous Components:		**Asbestos (ND)**					
Cellulose (Trace) Fibrous Glass (30 %)							
Comment: Bulk complex sample.							
EMR623-3	51673216						
Layer: Black Roof Shingle			**ND**				
Layer: Black Tars			**ND**				
Layer: Black Felts			**ND**				
Layer: Black Tar			**ND**				
Layer: Silver Paint			**ND**				
Total Composite Values of Fibrous Components:		**Asbestos (ND)**					
Cellulose (Trace) Fibrous Glass (30 %)							

20535 South Belshaw Avenue, Carson, CA 90746 | phone: 310.763.2374 / 800.813.9417 Fax: 310.763.4450 | https://falaboratories.sgs.com

Report Number: B349222

Client Name: Environmental Assistance Group **Date Printed:** 07/06/23

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
EMR623-4	51673217						
Layer: Black Roof Shingle			**ND**				
Layer: Black Tars			**ND**				
Layer: Black Felts			**ND**				
Layer: Silver Paint			**ND**				
Total Composite Values of Fibrous Components:		**Asbestos (ND)**					
Cellulose (Trace) Fibrous Glass (30 %)							
EMR623-5	51673218						
Layer: Black Roof Shingle			**ND**				
Layer: Black Tars			**ND**				
Layer: Black Felts			**ND**				
Layer: Silver Paint			**ND**				
Total Composite Values of Fibrous Components:		**Asbestos (ND)**					
Cellulose (Trace) Fibrous Glass (30 %)							
EMR623-6	51673219						
Layer: Black Roof Shingle			**ND**				
Layer: Black Tars			**ND**				
Layer: Black Felts			**ND**				
Layer: Silver Paint			**ND**				
Total Composite Values of Fibrous Components:		**Asbestos (ND)**					
Cellulose (Trace) Fibrous Glass (30 %)							
EMR623-7	51673220						
Layer: Black Roof Shingle			**ND**				
Layer: Black Tars			**ND**				
Layer: Black Felts			**ND**				
Layer: Silver Paint			**ND**				
Layer: Black Semi-Fibrous Material			**ND**				
Total Composite Values of Fibrous Components:		**Asbestos (ND)**					
Cellulose (Trace) Fibrous Glass (30 %)							
EMR623-8	51673221						
Layer: Black Roof Shingle			**ND**				
Layer: Black Tars			**ND**				
Layer: Black Felts			**ND**				
Layer: Silver Paint			**ND**				
Total Composite Values of Fibrous Components:		**Asbestos (ND)**					
Cellulose (Trace) Fibrous Glass (30 %)							

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Report Number: B349222

Client Name: Environmental Assistance Group **Date Printed:** 07/06/23

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
EMR623-9	51673222						
Layer: Black Roof Shingle			**ND**				
Layer: Black Tars			**ND**				
Layer: Black Felts			**ND**				
Layer: Black Tar			**ND**				
Layer: Black Felt			**ND**				
Layer: Silver Paint			**ND**				
Total Composite Values of Fibrous Components:		**Asbestos (ND)**					
Cellulose (Trace) Fibrous Glass (30 %)							
Comment: Bulk complex sample.							

Tiffani Ludd, Laboratory Supervisor, Carson Laboratory

Note: Limit of Quantification ('LOQ') = 1%. 'Trace' denotes the presence of asbestos below the LOQ. 'ND' = 'None Detected'.

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SGS FORENSIC LABORATORIES

Analysis Request Form (COC)

Client Name & Address: Client No.: L1206

Environmental Assistance Group
16835 Algonquin Street #412
Huntington Beach CA. 92649

PO / Job#: ~~NMSF88~~ EMR623 Date: 6.30.23

Turn Around Time: Same Day / ~~24hr~~ / 2Day / 3Day / 4Day / 5Day

~~PCM: NIOSH~~ 7400A / ☐ NIOSH 7400B ☐ Rotometer

PLM: ☐ Standard / ☐ Point Count 400 / 1000 / ☐ CARB 435

Contact: Ed Kennedy Phone: 661-304-8981

E-mail: comply@haztrainer.com

☐ TEM Air: ☐ AHERA / ☐ Yamate2 / ☐ NIOSH 7402
☐ TEM Bulk: ☐ Quantitative / ☐ Qualitative / ☐ Chatfield
☐ TEM Water: ☐ Potable / ☐ Non-Potable / ☐ Weight %
☐ TEM Dust: ☐ D5755 (microvac) / ☐ D6480 (wipe)

Site Name: ROSEMEAD H.S.

☐ IAQ Particle Identification ☐ Opaques/Char (Wildfire)
☐ Limited Particle ID (Wildfire) ☐ Special Project

Site Location: Gym Roof

☐ Metals Analysis Matrix: Method:
Analytes:

Comments: **Send additional report to peprby@gmail.com** 1 of 1

☐ Silica in Air ☐ w/Gravimetry
☐ Quartz Only

Sample ID	Date / Time	Sample Location / Description	FOR AIR SAMPLES ONLY				Sample Area / Air Volume
			Type	Time On/Off	Avg LPM	Total Time	
EMR623-1	6.30.23	Roll Roofing	A P C				
-2			A P C				
-3			A P C				
-4			A P C				
-5			A P C				
-6			A P C				
-7			A P C				
-8			A P C				
-9			A P C				
			A P C				

Sampled By: P Reby Date/Time: 6.30.23 Shipped Via: ☐ Fed Ex ☐ UPS ☐ US Mail ☐ Courier ~~☐ Drop Off~~ ☐ Other:

Relinquished By:	Relinquished By:	Relinquished By:
Date / Time: P Reby 6.30.23	Date / Time:	Date / Time:
Received By: D Valenzuela	Received By:	Received By:
Date / Time: 7/3/23 10:20 FIE	Date / Time:	Date / Time:
Condition Acceptable? ☐ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No

SGS FORENSIC LABORATORIES

Final Report

Bulk Asbestos Analysis

(EPA Method 40CFR, Part 763, Appendix E to Subpart E and EPA 600/R-93-116, Visual Area Estimation)
NVLAP Lab Code: 101459-1

Environmental Assistance Group
Ed Kennedy
16835 Algonquin St.
#412
Huntington Beach, CA 92649

Client ID: L1206
Report Number: B349328
Date Received: 07/07/23
Date Analyzed: 07/10/23
Date Printed: 07/10/23
First Reported: 07/10/23

Job ID/Site: EMRM723; Rosemead H.S.; Gym

Date(s) Collected: 07/07/2023

SGSFL Job ID: L1206
Total Samples Submitted: 7
Total Samples Analyzed: 7

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
EMRM723-1	51673800						
Layer: White Drywall			**ND**				
Layer: Paint			**ND**				
Total Composite Values of Fibrous Components: Cellulose (10 %) Fibrous Glass (3 %)		**Asbestos (ND)**					
EMRM723-2	51673801						
Layer: White Drywall			**ND**				
Layer: Paint			**ND**				
Total Composite Values of Fibrous Components: Cellulose (10 %) Fibrous Glass (3 %)		**Asbestos (ND)**					
EMRM723-3	51673802						
Layer: Grey Plaster			**ND**				
Layer: White Plaster			**ND**				
Layer: Paint			**ND**				
Total Composite Values of Fibrous Components: Cellulose (Trace)		**Asbestos (ND)**					
EMRM723-4	51673803						
Layer: Grey Plaster			**ND**				
Layer: White Plaster			**ND**				
Layer: Paint			**ND**				
Total Composite Values of Fibrous Components: Cellulose (Trace)		**Asbestos (ND)**					
EMRM723-5	51673804						
Layer: Yellow Fibrous Material			**ND**				
Layer: Brown Fibrous Material			**ND**				
Layer: Paint			**ND**				
Total Composite Values of Fibrous Components: Cellulose (65 %) Fibrous Glass (30 %)		**Asbestos (ND)**					
EMRM723-6	51673805						
Layer: Yellow Fibrous Material			**ND**				
Layer: Brown Fibrous Material			**ND**				
Layer: Paint			**ND**				
Total Composite Values of Fibrous Components: Cellulose (50 %) Fibrous Glass (45 %)		**Asbestos (ND)**					

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Report Number: B349328

Client Name: Environmental Assistance Group **Date Printed:** 07/10/23

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
EMRM723-7	51673806						
Layer: White Semi-Fibrous Material		Chrysotile	**3 %**	Amosite	**5 %**		
Layer: Paint			**ND**				
Total Composite Values of Fibrous Components:		**Asbestos (8%)**					
Cellulose (Trace)							

Tiffani Ludd, Laboratory Supervisor, Carson Laboratory

Note: Limit of Quantification ('LOQ') = 1%. 'Trace' denotes the presence of asbestos below the LOQ. 'ND' = 'None Detected'.

20535 South Belshaw Avenue, Carson, CA 90746 | phone: 310.763.2374 / 800.813.9417 Fax: 310.763.4450 | https://falaboratories.sgs.com

SGS FORENSIC LABORATORIES

Analysis Request Form (COC)

Client Name & Address: Client No.: 41206

Environmental Assistance Group
16835 Algonquin Street #412
Huntington Beach CA 92649

PO / Job#: EMRM723 Date: 7-7-23

Turn Around Time: Same Day / 1Day / 2Day / 3Day / 4Day / 5Day

☐ PCM: ☐ NIOSH 7400A / ☐ NIOSH 7400B ☐ Rotometer

☒ PLM: ☒ Standard / ☐ Point Count 400 / 1000 / ☐ CARB 435

Contact: Ed Kennedy Phone: 661-304-8981

E-mail: comply@haztrainer.com

☐ TEM Air: ☐ AHERA / ☐ Yamate2 / ☐ NIOSH 7402
☐ TEM Bulk: ☐ Quantitative / ☐ Qualitative / ☐ Chatfield
☐ TEM Water: ☐ Potable / ☐ Non-Potable / ☐ Weight %
☐ TEM Dust: ☐ D5755 (microvac) / ☐ D6480 (wipe)

Site Name: ROSEMEAD H.S.

☐ IAQ Particle Identification ☐ Opaques/Char (Wildfire)
☐ Limited Particle ID (Wildfire) ☐ Special Project

Site Location: GYM

☐ Metals Analysis Matrix: Method: Analytes:

Comments: **Please additionally email a copy to Perry Robey: peprby@gmail.com** 1 of 1

☐ Silica in Air ☐ w/Gravimetry ☐ Quartz Only

Sample ID	Date / Time	Sample Location / Description	FOR AIR SAMPLES ONLY: Type	Time On/Off	Avg LPM	Total Time	Sample Area / Air Volume
EMRM723-1	7-7-23		A P C				
-2			A P C				
-3			A P C				
-4			A P C				
-5			A P C				
-6			A P C				
-7			A P C				
			A P C				
			A P C				
			A P C				

Sampled By: Perry Robey Date/Time: 7.7.23 Shipped Via: ☐ Fed Ex ☐ UPS ☐ US Mail ☐ Courier ☒ Drop Off ☐ Other:

Relinquished By: Perry Robey	Relinquished By:	Relinquished By:
Date / Time: 7.7.23	Date / Time:	Date / Time:
Received By: B. Valencia	Received By:	Received By:
Date / Time: 7/7/23 12:12 D/O	Date / Time:	Date / Time:
Condition Acceptable? ☐ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No

V. LEAD SAMPLING RESULTS REPORT

SGS FORENSIC LABORATORIES

Final Report

Metals Analysis of Paints

(AIHA-LAP, LLC Accreditation, Lab ID #101629)

Environmental Assistance Group
Ed Kennedy
16835 Algonquin St.
#412
Huntington Beach, CA 92649

Client ID: L1206
Report Number: M252080
Date Received: 07/07/23
Date Analyzed: 07/10/23
Date Printed: 07/10/23
First Reported: 07/10/23

Job ID / Site: EMRM723PB; Rosemead H.S; Gym
Date(s) Collected: 07/07/2023

SGSFL Job ID: L1206
Total Samples Submitted: 7
Total Samples Analyzed: 7

Sample Number	Lab Number	Analyte	Result	Result Units	Reporting Limit*	Method Reference
EMRM723PB-1	LM251880	Pb	0.13	wt%	0.006	EPA 3050B/7000B
EMRM723PB-2	LM251881	Pb	0.18	wt%	0.02	EPA 3050B/7000B
EMRM723PB-3	LM251882	Pb	0.13	wt%	0.006	EPA 3050B/7000B
EMRM723PB-4	LM251883	Pb	< 0.006	wt%	0.006	EPA 3050B/7000B
EMRM723PB-5	LM251884	Pb	0.12	wt%	0.006	EPA 3050B/7000B
EMRM723PB-6	LM251885	Pb	< 0.006	wt%	0.006	EPA 3050B/7000B
EMRM723PB-7	LM251886	Pb	< 0.006	wt%	0.006	EPA 3050B/7000B

* The Reporting Limit represents the lowest amount of analyte that the laboratory can confidently detect in the sample, and is not a regulatory level. The Units for the Reporting Limit are the same as the Units for the Final Results.

Beatriz Hinojosa, Laboratory Supervisor, Carson Laboratory

20535 South Belshaw Avenue, Carson, CA 90746 | phone: 310.763.2374 / 800.813.9417 Fax: 310.763.4450 | https://falaboratories.sgs.com

SGS FORENSIC LABORATORIES

Analysis Request Form (COC)

Client Name & Address: Client No.: 41206

Environmental Assistance Group
16835 Algonquin Street #412
Huntington Beach CA 92649

PO / Job#: EMRM723Pb Date: 7.7.23

Turn Around Time: Same Day / 1Day / 2Day / 3Day / 4Day / 5Day

☐ PCM: ☐ NIOSH 7400A / ☐ NIOSH 7400B ☐ Rotometer

☐ PLM: ☐ Standard / ☐ Point Count 400 / 1000 / ☐ CARB 435

Contact: Ed Kennedy Phone: 661-304-8981

E-mail: comply@haztrainer.com

☐ TEM Air: ☐ AHERA / ☐ Yamate2 / ☐ NIOSH 7402
☐ TEM Bulk: ☐ Quantitative / ☐ Qualitative / ☐ Chatfield
☐ TEM Water: ☐ Potable / ☐ Non-Potable / ☐ Weight %
☐ TEM Dust: ☐ D5755 (microvac) / ☐ D6480 (wipe)

Site Name: ROSEMEAD H.S.

☐ IAQ Particle Identification ☐ Opaques/Char (Wildfire)
☐ Limited Particle ID (Wildfire) ☐ Special Project

Site Location: GYM

☑ Metals Analysis Matrix: Paint Method: AA
Analytes: LEAD

Comments: **Please additionally email a copy to Perry Robey: peprby@gmail.com** Report By % in Weight

☐ Silica in Air ☐ w/Gravimetry ☐ Quartz Only

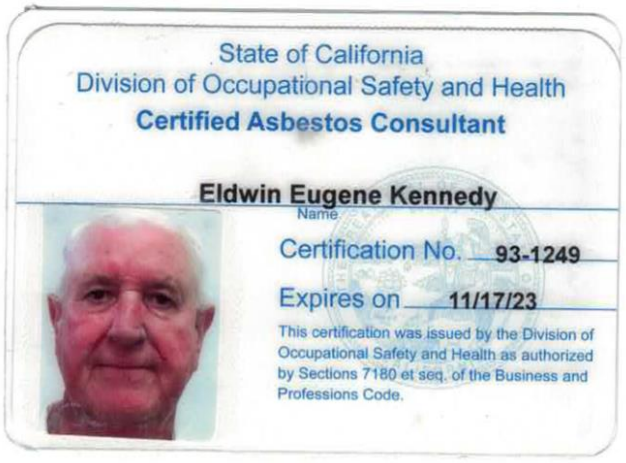
Sample ID	Date / Time	Sample Location / Description	FOR AIR SAMPLES ONLY Type	Time On/Off	Avg LPM	Total Time	Sample Area / Air Volume
EMRM723Pb-1	7.7.23		[A] [P] [C]				
-2	"		[A] [P] [C]				
-3	"		[A] [P] [C]				
-4	"		[A] [P] [C]				
-5	"		[A] [P] [C]				
-6	"		[A] [P] [C]				
-7	"		[A] [P] [C]				
-8	"		[A] [P] [C]				
-9	"		[A] [P] [C]				
			[A] [P] [C]				

Sampled By: Perry Robey Date/Time: 7.7.23 Shipped Via: ☐ Fed Ex ☐ UPS ☐ US Mail ☐ Courier ☑ Drop Off ☐ Other:

Relinquished By: Perry Robey	Relinquished By:	Relinquished By:
Date / Time: 7.7.23	Date / Time:	Date / Time:
Received By: Jazmine Contreras	Received By:	Received By:
Date / Time: 7-7-23 12:12pm	Date / Time:	Date / Time:
Condition Acceptable? ☐ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No

VI. INSPECTOR’S CERTIFICATIONS

VI. INSPECTORS CERTIFICATIONS



State of California
Division of Occupational Safety and Health
Certified Asbestos Consultant

Eldwin Eugene Kennedy
Name

Certification No. **93-1249**

Expires on **11/17/23**

This certification was issued by the Division of Occupational Safety and Health as authorized by Sections 7180 et seq. of the Business and Professions Code.

California Department of PublicHealth

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC HEALTH

LEAD-RELATED CONSTRUCTION CERTIFICATE

INDIVIDUAL:	CERTIFICATE TYPE:	NUMBER:	EXPIRATION DATE:
	Lead Project Designer	LRC-00002680	8/23/2023
	Lead Inspector/Assessor	LRC-00002679	8/23/2023
	Lead Supervisor	LRC-00002678	8/23/2023

Eldwin Kennedy

Disclaimer: This document alone should not be relied upon to confirm certification status. Compare the individual's photo and name to another valid form of government issued photo identification. Verify the individual's certification status by searching for Lead-Related Construction Professionals at www.cdph.ca.gov/programs/clpph or calling (800) 597-LEAD

State of California
Division of Occupational Safety and Health
Certified Site Surveillance Technician

Perry B Robey
Name

Certification No. **22-7026**

Expires on **07/15/24**

This certification was issued by the Division of Occupational Safety and Health as authorized by Sections 7180 et seq. of the Business and Professions Code.

VII. DISCLAIMER/REPORT LIMITATIONS

VII. DISCLAIMER/ REPORT LIMITATIONS

All reports and recommendations are based on conditions and practices observed and information made available to Environmental Assistance Group (EAG) by the client and the designated sites/facilities on the days the abatement was completed. Services provided by EAG shall be governed by the standard of practice for professional services measured at the time those services are rendered.

All information contained in this report is proprietary and limited to the scope of services, parameters of the analytical methods used, and the conditions present at the time of this oversight and monitoring. Any references to quantities are considered estimates and are not to be construed as actual.

EXHIBIT “E”

ASBESTOS ABATEMENT AND

LEAD CONTAINING PAINT STABILIZATION

IN THE BOYS LOCKER BUILDING

El MONTE UNION HIGH SCHOOL DISTRICT LEAD ABATEMENT
ROSEMEAD HIGH SCHOOL
ASBESTOS ABATEMENT AND
LEAD CONTAINING PAINT STABILIZATION
IN THE BOYS LOCKER BUILDING

Job Walk: December 28, at 2.00 PM: Mandatory.
Main Office: 9063 E. Mission Drive Rosemead, California 91770

Bids Due: December 29 at **1:00 PM.**

E-Mail Bids with submittals to:

Ms. Norma Macias. norma.macias@emuhsd.org
Director of Facilities, Maintenance, Operations and Transportation
And
Mr. Jorge Estrada. jorge.estrada@emuhsd.org
Maintenance Coordinator:
And
Mr. Ed Kennedy. comply@haztrainer.com .

Project Dates:
To Be Determined

Submittals:
Proof of CUPPCA compliance.
Proof of Approved insurance.
Proof of Asbestos and Lead trained workers and supervisors.
Proof of required Regulatory Agency notifications.
Final closeout documentation within 10 days of project completion including employee sign-in sheets, employee physical certifications, work project logs, personal air sampling results, waste characterization, TCLP results, Hazardous Waste Manifests and project work location schedule.

Forward all submittals to **Mr. Jorge Estrada** **jorge.estrada@emuhsd.org**

Asbestos Abatement Scope of Work

ROSEMEAD HIGH SCHOOL

- Boys Locker Building Team Room, Hall and Ceiling Spaces. 70% Chrysotile on pipe insulation in ceiling space and possible in walls.

Aircell pipe insulation and plaster:

Utilize 4 mil polyethylene sheeting to establish critical barriers and full containment. Establish negative air sufficient to ensure four air changes per hour, including the ceiling space. Remove accessible pipe insulation and dispose of as hazardous waste. Remove water damaged plaster above the electrical panel and as necessary to expose insulated water pipe to the point of leak.

Lead Paint Stabilization Scope of Work

ROSEMEAD HIGH SCHOOL

- Boys Locker Team room and Hall: 0.28 % lead by weight.

<u>Loose and peeling Lead Containing Paint associated with interiors of rooms per scope of work.</u>

Move and/or cover furniture and other furnishings as needed to complete the scope of Completely remove paint chips and paint residue from adjacent ground surfaces. Install 4 mil. polyethylene (poly) critical barriers and drops. Utilize barricade caution tape with lead hazard warning to surround the areas where work is occurring. Provide clean changing areas with lead hazard warning signs. Control emissions from work progress such that no visible dry emissions are released. Contain and collect all waste and accumulated media including paint chips, dust and water and dispose of as appropriate after waste characterization. Stabilize areas of disturbed coatings with an approved lead blocker paint. Contractor is responsible for appropriate waste testing and disposal.

BID FORM

The El Monte Union High School District reserves the right to accept or reject any bid.

Please use this form and include page 1, 2 and 3 of this El MONTE UNION HIGH SCHOOL DISTRICT ASBESTOS and LEAD ABATEMENT document as well as the EMUHSD Request for Proposal Form for your bid

Rosemead High School: Asbestos and Lead Abatement per Scope of Work

Prevailing Wage: This is a prevailing wage project.

Aircell Pipe Insulation, Plaster and Loose and Peeling Lead Containing Paint Stabilization

Includes Boys Team Room and Hall Areas. Scope of Work

TOTAL LUMP SUM BID $_____

Total Lump sum bids including cost of all materials and labor and expenses to complete the attached scope of work.

Contractor Name: _____

Representative Name: _____

Contact Information: _____(Cell)

_____ (Email)

Contractor Address: _____

_____

REQUEST FOR PROPOSAL

PUBLIC WORKS SERVICES UNDER THE CALIFORNIA UNIFORM PUBLIC CONSTRUCTION COST ACCOUNTING ACT

PLEASE FAX/EMAIL RESPONSE TO:
Claudia Sanchez, Director of Purchasing
Email: claudia.sanchez@emuhsd.org
Fax: (626) 522 - 4810

MANDATORY JOB WALK:
Monday 12- 28, 2020 – 2:00 p.m.
PROPOSALS DUE:
Tuesday 12- 29, 2020 – 1:00p.m.

Contractor Information:

Company Name: _____ Contact: _____

Address: _____ Phone: _____

Email: _____ Fax: _____

Please provide a proposal for the following scope of services: **Rosemead High School**

Project Name: **Asbestos Abatement and Lead Paint Stabilization, Team Room and Hall**

SCOPE OF WORK:

Asbestos Abatement

ROSEMEAD HIGH SCHOOL

- Hall Ceiling space and Hall ceiling and wall.

Pipe insulation and plaster removal:

Lead Paint Stabilization

ROSEMEAD HIGH SCHOOL

- Team Room and adjacent Hall: 0.015 to 0.28 % lead by weight.

Loose and peeling Lead Containing Paint associated with interior areas.

Days to complete project: _____

By executing this Proposal, the Contractor hereby certifies that: (a) it is duly licensed, in the necessary class(es), for performing the required Work; (b) that such license shall be in full force and effect throughout the duration of the performance of the Work; and, (c) that all Subcontractors providing or performing any portion of the Work shall be so similarly and appropriately licensed to perform or provide such portion of the Work.
Proposal attached: ____

Bidding: __ Yes __ No

*Attach This form and completed First 3 Pages of Scope of Work and Specifications Bid Document in your proposal.

_____ _____
Contractor Signature Date

NOTE: Pursuant to SB 854, Contractors are required to register with the Department of Industrial Relations prior to bidding on public agency projects under the following conditions: Public Works Projects > $25,000; Maintenance Projects > $15,000

Asbestos Abatement Specifications

PART 1 GENERAL

1.1 SCOPE-The purpose of this specification is to minimize asbestos exposure to El Monte Union High School District (EMUHSD), students, visitors and staff, during removal of building materials that contain asbestos.

1.2 DESCRIPTION OF WORK

1.2.1.1 The work specified herein shall be the removal of asbestos-containing material by contract with persons knowledgeable, qualified, and certified in the removal, treatment, handling, and disposal of asbestos-containing material, and the subsequent cleaning of the affected environment, who comply with Federal and State Regulations which mandate work practices, and who are capable of performing the work of this contract.

1.2.1.2 The asbestos removal contractor shall supply all labor, materials, equipment, services, insurance, and incidentals which are necessary or required to perform the work in accordance with applicable governmental regulations and these specifications. Insurance includes automotive, general, environmental pollution and workers' compensation insurance.

1.3 TERMINOLOGY

1.3.1 Building Owner- The EMUHSD.

1.3.2 Authorized Visitor- The building owner, Consultant, and any representative of a regulatory or other agency having jurisdiction over the project.

1.3.3 Abatement-Procedures to control fiber release from asbestos-containing building materials.

1.3.4 Removal-All herein specified procedures necessary to remove asbestos containing materials from the designated areas and to dispose of these materials at an acceptable site.

1.3.7 Air Monitoring- The process of measuring the fiber content of a specific volume of air in a stated period of time.

1.3.8 HEPA Vacuum Equipment- Vacuuming equipment with a HEPA filter system.

1.3.9 HEPA Filter- A high efficiency particulate absolute (HEPA) filter capable of trapping and retaining 99.97 percent of particles (asbestos fibers) greater than 0.3 micrometers in mass median aerodynamic equivalent diameter.

1.3.10 Surfactant- A chemical wetting agent added to water to improve penetration.

1.3.11 Amended Water- Water to which a surfactant has been added.

1.3.12 Airlock- A system for permitting ingress and egress with minimum air movement between a contaminated area and an uncontaminated area.

1.3.13 Curtained doorway- A device to allow ingress or egress from one room to another while permitting minimal air movement between the rooms, typically constructed by placing two overlapping sheets of plastic over an existing or temporarily framed doorway, securing each along the top of the doorway, securing the vertical edge of one sheet along one vertical side of the doorway, and securing the vertical side of the doorway.

1.3.14 Decontamination Enclosure System- A series of connected rooms, with curtain doorways between any two adjacent rooms, for the decontamination of workers and of materials and equipment. A decontamination enclosure system always contains at least one airlock.

1.3.15 Worker Decontamination Enclosure System- That portion of a decontamination enclosure system designed for controlled passage of workers, and other personnel and authorized visitors, typically consisting of a clean room, a shower room, and an equipment room.

1.3.16 Equipment Decontamination Enclosure- That portions of a decontamination enclosure system designed for controlled transfer of materials and equipment, typically, consisting of a washroom and a holding area.

1.3.17 Clean Room- An uncontaminated area or room which is a part of the worker decontamination enclosure with provisions for storage of workers' street clothes and protective equipment.

1.3.18 Shower Room- A room between the clean room and the equipment room in the worker decontamination enclosure with hot and cold or warm running water and suitable arranged for complete showering during decontamination. The shower room comprised an airlock between contaminated clothing and equipment.

1.3.20 Washroom- A room between the work area and the holding area in the equipment decontamination enclosure system. The washroom comprised an airlock.

1.3.21 Holding Area- A chamber in the equipment decontamination enclosure located between the washroom and an uncontaminated area. The holding area comprises an airlock.

1.3.22 Fixed Object- A unit of equipment or furniture in the work area which can be removed from the work area.

1.3.25 Wet Cleaning- The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning tools which have been dampened with water, and by afterwards disposing of these cleaning tools as asbestos contaminated waste.

1.3.26 Negative Air Pressure Equipment- A portable local exhaust system equipped with HEPA filtration and capable of maintaining a constant, low velocity air flow into contaminated areas from adjacent uncontaminated areas.

1.3.27 Plasticize- To cover floors and walls with plastic sheeting as herein specified.

1.3.28 Work Area- Designated rooms, spaces, or areas of the project in which asbestos abatement actions are to be undertaken or which may become contaminated as a result of such abatement actions. A contained work area is a work area which has been sealed, plasticized, and equipped with a decontamination enclosure system. A non-contained work area is an isolated or controlled-access work area which has not been plasticized nor equipped with decontamination enclosure system.

1.3.29 Glove bag Technique- A method with limited applications for removing small amounts of friable asbestos-containing material from HVAC ducts, short piping runs, valves, joints, elbows, and other non-planar surfaces in a contained work area. The Glove bag assembly is a manufactured or fabricated device consisting of a Glove bag (typically constructed 6 mil transparent regulate plastic), two inward projecting long sleeve rubber gloves, one inward projecting water wand sleeve, an internal tool pouch, and an attached, labeled receptacle for asbestos waste. The Glove bag is constructed and installed in such a manner that it surrounds the object or area to be decontaminated and contains all asbestos fibers released during the removal process. All workers who are permitted to use the Glove bag technique must have complete a certification course.

1.3.30 Consultant/Air Sampling Professional-The professional contracted or employed to supervise air monitoring and analysis schemes. This individual is also responsible for recognition of technical deficiencies in worker protection equipment and procedures during both planning and on-site phases of an abatement project. This individual should have specialized experience and training in air sampling for asbestos and complete the "NIOSH 582 Course".

1.4 APPLICABLE DOCUMENTS (References)-The current issue of each document shall govern. Where conflict among requirements or with these specifications exists, the more stringent requirements shall apply.

1.4.1 Regulations- Comply with applicable Federal, State, and local regulations.

1.4.1.2 Title 29, Code of Federal Regulations, Section 1910.1001. and Section 1926.1101. Occupational Safety and Health Administration (OSHA), US Department of Labor.

1.4.1.3 Title 40, Code of Federal Regulations, Part 61, Subparts A and B, National Emission Standards for Hazardous Air Pollutants. US Environmental Protection Agency (EPA).

1.4.1.4 South Coast Air Quality Management District

1.4.1.5 All State, County, and City codes and ordinances as applicable.

1.5 SUBMITTALS AND NOTICES

1.5.1 Prior to Commencement of Work

1.5.1.1 The Asbestos Abatement Contractor shall make required notifications to Cal OSHA as required

1.5.1.2 The Asbestos Abatement Contractor shall submit written notice to SCAQMD of proposed abatement work as required

1.5.1.3 Post caution signs in and around the work area to comply with regulations.

1.5.1.4 El Monte Union High School District and the asbestos abatement contractor must agree on building and fixture condition prior to commencement of work.

1.5.1.5 Manufacturer's certification that vacuums, negative air pressure equipment, and other local exhaust ventilation equipment conform to ANSI 29.2-79 and SCAQMD requirements

1.6 PERSONNEL PROTECTION

1.6.1 Prior to commencement of work, the workers shall be instructed, and shall be knowledgeable, in emergency evacuation and evacuation procedures as needed prior to commencement of work.

1.6.2 All respiratory protection shall be provided to workers in conjunction with a respiratory protection program which shall meet the requirements of applicable regulations. This program shall be posted at the work site.

1.6.3 Provide workers with personally issued and marked respiratory equipment approved by The National Institute for Occupational Safety and Health (NIOSH).

1.6.4 Respiratory protection shall be worn by all persons potentially exposed to asbestos from the initiation of the asbestos demolition project until all areas have been given clearance. Clearance shall be obtained by visual inspection and air monitoring as needed.

1.6.4.1 All asbestos abatement workers entering the Work Area after commencement of asbestos removal shall wear appropriate respirators. Respirators shall be required until gross asbestos removal and until the areas have passed clearance tests.

1.6.4.2 If required, compressed air systems shall be designed to provide air volumes and pressures to accommodate respirator manufacturer's specifications. The compressed air systems shall have a receiver of adequate capacity to allow escape of all respirator wearers from contaminated area in the event of compressor failure. Compressors must meet the requirements of 29 CFR 1910.134(d). Compressors must have an in-line carbon monoxide monitor, and periodic inspection of the carbon monoxide monitor must be evidenced. Documentation of adequacy of compressed air system/respiratory protection system must be retained on site. This documentation will include a list of compatible components with the maximum number and type of respirators that may be used with the system. Periodic testing of compressed air shall insure that systems provide air of sufficient quality.

1.6.4.3 The minimum type of respiratory protection to be used for protection from asbestos during work in areas other than 1.6.4.1 is the Negative Air Purifying Respirator with High Efficiency (HEPA) Filtration.

1.6.4.4 Provide authorized visitors with suitable respirators and respiratory training whenever they are require to enter the work area to a maximum of 4 per day.

1.6.5 Provide workers with sufficient sets of protective full body clothing. Such clothing shall consist of full body coveralls and headgear. Provide eye protection and hard hats as required by applicable safety Regulations. Disposable type protection clothing, headgear, and footwear may be provided.

1.6.6 Provide authorized visitors with suitable protective clothing, headgear, eye protection, and footwear, as described in Section 1.6.4, whenever they are required to enter the work area, to a minimum of 4 sets per shift.

1.6.7 Provide and post, in the Equipment Room and the Clean Room, the decontamination and work procedures to be followed by workers, as described in Section 1.6.8 of these specifications.

1.6.8 Worker Protection Procedures

1.6.8.1 When practicable, each worker and authorized visitor shall, upon entering the job sites: remove street clothes in the clean changed room and put on a respirator and clean protective clothing before entering the Equipment Room or Work Area.

1.6.8.2 All workers and authorized visitors shall, each time they leave the Work Area: remove gross contamination from clothing before leaving the Work Area; proceed to the Equipment Room and remove all clothing except respirators; still wearing respirator proceed naked to the showers; clean the outside of the respirator with soap and water while showering; remove the respirator; thoroughly shampoo and wash themselves.

1.6.8.3 Following showering and drying off, each worker and authorized visitor shall proceed directly to the clean change room and dress in clean clothes at the end of each day's work, or before eating, smoking, or drinking. Before reentering the Work Area from the clean changed room, each worker and authorized visitor shall put on a clean respirator and shall dress in clean protective clothing.

1.6.8.4 Contaminated work footwear shall be stored in the Equipment Room when not in use in the Work Area. Upon completion of asbestos abatement, dispose of footwear as contaminated waste.

1.6.8.5 Workers removing waste containers from the Equipment Decontamination Enclosure shall enter the Holding Area from outside wearing a respirator and dressed in clean disposable coveralls. No worker shall use this system as a means to leave or enter the Washroom or the Work Area.

1.6.8.6 Workers shall not eat, drink, smoke, or chew gum or tobacco while in the Work Area.

1.7 EQUIPMENT REMOVAL PROCEDURES

1.7.1 Clean surfaces of contaminated containers and equipment thoroughly by wet sponging or wiping before moving such items into the Equipment Decontamination Enclosure System Washroom for final cleaning and removal to uncontaminated areas. Ensure that personnel do not leave the Work Area through the Equipment Decontamination Enclosure.

1.8 BUILDING PROTECTION

PART 2-MATERIALS AND EQUIPMENT

2.1 MATERIALS

2.1.1 Deliver all materials in the original packages, containers, or bundles bearing the name of the manufacturer and the brand name.

2.1.1.2 Store all materials subject to damage off the ground away from wet or damp surfaces, and under cover sufficient to

prevent damage or contamination.

2.1.1.3 Damaged or deteriorating materials shall not be used and shall be removed from the premises and properly disposed of.

2.1.2 Plastic (polyethylene) sheet, of 4-mil thickness or greater as specified, in sized to minimize the frequency of joints.

2.1.3 Tape- capable of sealing joints of adjacent sheets of plastic sheets and for attachment of plastic sheet to finished or unfinished surfaces of dissimilar materials and capable of adhering under both dry and wet conditions, including use of amended water.

2.1.4 Surfactant (wetting agent)- shall consist of 50 percent polyoxyethylene ether and 50 percent of polyoxyethylene polyglycol ester, or equivalent, and shall be mixed with water to provide a concentration of one once surfactant to 5 gallons of water or as directed by manufacturer.

2.1.5 Impermeable containers- suitable to receive and retain any asbestos-containing or contaminated materials until disposal at an acceptable disposal site. (The containers shall be labeled in accordance with OSHA Regulation 29 CFR 1910.1200(f)). Containers must be both air and watertight and allow for view of the contents

2.1.6 Warning labels and signs- as required by OSHA Regulation 29 CFR 1926.1101(k)(7)(iii).

2.1.8 Spray or trowel applied fire resistant materials- ULI labeled and listed asbestos-free (mineral/fiber) (cementitious) material to provide the degree of fire protection required by the applicable building code.

2.1.9 Spray or trowel-applied thermal or acoustical insulation material used for patching or replacement must provide performance characteristics equivalent to or better than original material.

2.2 TOOLS AND EQUIPMENT

2.2.1 Provide suitable tools for asbestos abatement.

2.2.1.1 Negative air pressure equipment- High efficiency particulate absolute (HEPA) filtration systems shall be equipped with filtration equipment in compliance with ANSI 29.2-79, local exhaust ventilation. No air movement system or air filtering equipment shall discharge unfiltered air outside the Work Area.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Work Areas:

3.1.1.1 Shut down and tag out electric power and natural gas prior to working on any affected equipment. If required, provide temporary power and lighting and ensure safe installation of temporary power sources and equipment per applicable electrical code requirements.

3.1.1.2 Shut down and isolate heating, cooling, and ventilating air systems to prevent contamination and fiber dispersal to other areas of the structure. During the work, vents within the Work Area shall be sealed with tape and plastic sheeting.

3.1.1.3 Pre-clean movable objects within the proposed work areas using HEPA vacuum equipment and/or wet cleaning methods as appropriate, and remove such objects from work areas to a temporary location. Where scheduled to be removed, carpeting shall be disposed of as contaminated material.

3.1.1.4 Pre-clean fixed objects within the proposed work areas, using HEPA vacuum equipment and/or wet cleaning methods as appropriate, and enclose within minimum 4 mil plastic sheeting sealed with tape.

3.1.1.5 Clean the proposed work areas using HEPA vacuum equipment or wet cleaning methods as appropriate. Do not use methods that raise dust, such as dry sweeping or vacuuming with equipment not equipped with HEPA filters.

3.1.1.6 Seal off all openings, including but not limited to windows, corridors, doorways, skylights, ducts, grills, diffusers, and any other penetrations of the work areas, with plastic sheeting (minimum of 4 mils thick) sealed with tape. Doorways and corridors which will not be used for passage during work, must be sealed with barriers as described in 3.1.2.4.

3.1.1.7 Cover floor and wall surfaces with plastic sheeting sealed with tape. Use a minimum of two layers of 6 mil plastic on floors and two layers of 4 mil plastic on walls. Cover floors first so that plastic extends at least 12 inches up on walls, then cover walls with plastic sheeting to the floor level, thus overlapping the floor material by a minimum of 12 inches.

3.1.1.8 Provide airlocks at entrances to and exits from the work areas.

3.1.1.9 Remove and clean ceiling mounted objects, such as lights and other items not previously sealed off, that interfere with asbestos abatement. Use handheld water spraying or HEPA vacuum equipment during fixture removal to reduce fiber dispersal. See paragraph for work by other trades.

3.1.1.10 Maintain emergency and fire exits from the work areas, or establish alternative exits satisfactory to fire officials.

3.1.1.11 When applicable, after preparation of work areas and decontamination enclosure systems, remove ceiling (panels and tiles) within the work areas progressively and carefully, (clean using HEPA vacuum equipment and damp sponge and wrap clean (panels and tiles) in 4 mil minimum thickness plastic and store in building as directed by building owner and dispose of as contaminated waste,

3.1.1.12 Where suspended ceiling suspension systems, such as T-grids, must be removed to expose and make work areas accessible, clean T-grid using wet methods, disconnect grid from hangers, wrap cleaned grid members in 4 mil. minimum thickness plastic and store as directed by building owner or dispose of T-grid members as contaminated waste.

3.1.1.13 Where removal of suspended ceiling grid suspension systems is not required for work area accessibility, leave the grid system in place and, upon completion of the abatement work, clean the grid system as specified in 3.5.

3.1.1.14 After preparation of work areas and decontamination enclosure systems, remove plaster ceilings, including lath, furring channel system (grid), wire ties, clips, screws, and other accessory items and dispose of as contaminated waste. Spray ceiling debris and the immediate work area with amended water to reduce dust as the work progresses.

3.1.2 Decontamination Enclosure systems:

3.1.2.1.1 Build suitable framing as described herein and approved by the architect at shop drawing submittal stage. Portable prefab units, if utilized, must be submitted for review and approval by the architect before start of construction. Submittal shall include, but not be limited to, a floor plan layout complying with schematic layout bound herein, showing dimensions, materials, sizes, thickness, plumbing, and electrical outlets, etc.

3.1.2.1.2 In all cases access between contaminated and uncontaminated rooms or areas shall be through an airlock as described in Section 1.3. In all cases, access between any two rooms within the decontamination enclosure systems shall be through a curtained doorway.

3.1.2.2 Worker Decontamination Enclosure: As required, construct a workers decontamination enclosure system contiguous to the work area consisting of three totally enclosed chambers to conform as follows.

3.1.2.2.1 An Equipment Room with two curtained doorways, one to the work area and one to the shower rooms.

3.1.2.2.2 A Shower Room with two curtained doorways, one to the equipment room and one to the clean room. The Shower Room shall contain at least one shower with hot and cold or warm water. Careful attention shall be paid to the shower enclosure to ensure against leaking of any kind. Ensure a supply of soap and disposable towels at all times in the shower room.

3.1.2.2.3 A Clean Room with one curtained doorway into the shower and one entrance or exit to non-contaminated areas of the building. The Clean Room shall have sufficient space for storage of the worker's street clothes, towels, and other non-contaminated items. Joint use of this space for other functions, such as offices, storage of equipment, materials, or tools, shall be prohibited.

3.1.2.3 Equipment Decontamination Enclosure: Provide or construct an Equipment Decontamination Enclosure system consisting of two totally enclosed chambers as follows:

3.1.2.3.1 A Washroom, constituting an airlock, with a curtained doorway to a designated staging area of the Work Area and a curtained doorway to the holding area.

3.1.2.3.1 A Holding Area, constituting an airlock, with a curtained doorway to the Washroom, and a curtained doorway to an uncontaminated area.

3.1.2.4 Separation of work areas from occupied areas.

3.1.2.4.1 Separate parts of the building required to remain in use from parts of the building that will undergo asbestos abatement by means of airtight barriers, constructed as follows:

3.1.2.4.1 Build suitable wood or metal framing and apply 3/8" minimum thickness sheathing on work side only unless noted otherwise.

3.1.2.4.1.2 Cover both sides of partition with double layer of plastic sheet with joints staggered and sealed with tape. Edges of partition at floor, walls, and ceiling shall be caulked airtight.

3.1.2.5 Maintenance of Enclosure systems:

3.1.2.5.1 Ensure that barriers and plastic linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.

3.1.2.5.2 Visually inspect enclosures at the beginning of each work period.

3.1.2.5.3 Use smoke methods to test effectiveness of barriers when directed by architect/engineer/consultant.

3.1.2.6 Asbestos abatement work shall not commence until:

3.1.2.6.1 Arrangements have been made for disposal of waste at an acceptable site.

3.1.2.6.2 Work Areas and decontaminated enclosure systems and parts of the building required to remain in use are effectively segregated.

3.1.2.6.3 Tools, equipment, and material waste receptors are on hand.

3.1.2.6.4 Arrangements have been made for building security.

3.1.2.6.5 All other preparatory steps have been taken and applicable notices posted and permits obtained.

3.1.2.6.6 All worker training has been completed and documentation is on site.

3.1.2.6.7 Abatement work will not begin until the consultant has authorized work to commence.

3.2 ASBESTOS REMOVAL

3.2.1 Prepare site (see section 3.1)

3.2.2 Spray asbestos material with amended water, using spray equipment capable of providing a "mist" application to reduce the release of fibers. Saturate the material sufficiently to wet it to the substrate without causing excess dripping. Spray the asbestos material repeatedly during work process to maintain wet condition and to minimize asbestos fiber dispersion.

3.2.3 In order to maintain indoor asbestos concentrations at a minimum, the saturated asbestos must be removed in manageable section. Material shall not be allowed to dry out. Material drop shall not exceed 15 feet. For heights up to 50 feet, provide inclined chutes or scaffolding to intercept drop. For heights exceeding 50 feet provide enclosed dust-proof chutes.

3.2.4 Seal filled containers. Place caution labels on containers in accordance with OSHA Regulation 29 CFR 1926.1101(k)(7) if not already preprinted on containers. Clean external surfaces of containers thoroughly by wet sponging in the designated area. Move containers to the washroom, wet clean each container thoroughly, and move to holding area pending removal to uncontaminated areas. Ensure that containers are removed from the holding area by workers who have entered from uncontaminated areas dressed in clean coveralls. Ensure that workers do not enter from uncontaminated areas into the washroom or the work area; ensure that contaminated workers do not exit the work area through the Equipment Decontamination Enclosure System.

3.2.5 After completion of stripping work, all surfaces from which asbestos has been removed shall be wet brushed and sponged or cleaned by an equivalent method to remove all visible material. During this work, the surfaces being cleaned shall be kept wet.

3.2.6 After substrate is dry and is visibly free of asbestos materials and before plastic sheeting is removed, the plastic sheeting and substrate shall be sprayed with one (1) coat of approved encapsulate sealer following manufacturer's recommendations for applications.

3.2.7 Clean up shall be in accordance with Section 3.5.

2.3.8 If at any time during the removal air testing or visual inspections indicate contamination of areas outside the work area, immediate steps shall be taken by the contractor to decontaminate these areas. Unprotected individuals shall be prohibited from entering contaminated areas until air sampling and visual inspections certify decontamination.

CLEANUP

Remove visible accumulations of asbestos material and debris. Wet clean all surfaces within the work area.

Remove the cleaned outer layer of plastic from walls and floors. The windows, doors, and HVAC vents shall remain sealed and any HEPA filtration negative air pressure systems and decontamination enclosure systems shall remain in service.

After cleaning the work area, wait at least 2 hours to allow for the settlement of dust, and again wet clean or clean with HEPA vacuum equipment all surfaces in the work area. After completion of the second cleaning operation, perform a complete visual inspection of the work area to ensure that the work area is free of contamination.

Sealed drums and all equipment used in the work area shall be included in the cleanup and shall be removed from work areas, via the Equipment Decontamination Enclosure at an appropriate time in the cleaning sequence.

If the building owner finds visible accumulations of dust in the work area, the contractor shall repeat the wet cleaning until the work area is in compliance, at the contractor's expense.

INITIAL CLEARANCE TESTING

Upon notice from contractor that work areas and all other contaminated and cleaned areas area ready for initial clearance testing. The Consultant shall test for the Standard of Cleaning for Initial Clearance of 0.01 or less fibers/cc of air. Air monitoring volumes shall be sufficient to provide a detection limit of 0.01 or less fibers/cc of air.

Areas which do not comply with the Standard for Cleaning for Initial Clearance shall continue to be cleaned by and at the contractor's expense until the specified Standard of Cleaning is achieved as evidenced by results of air testing as previously specified.

Upon successful compliance with the Standard of Cleaning for Initial Clearance, mandatory respiratory protection for workers engaged in re-spray or finishing work in the work area may be waived at the discretion of the contractor. After initial clearance, the final layer of plastic may be removed by workers with proper respiratory protection. However, controls established in 3.1.1.6 may not be removed at this point.

Reoccupancy Clearance

At the request of the asbestos abatement supervisor, The Consultant will perform a re-occupancy visual inspection of the

work area. Evidence of asbestos contamination identified during the inspection will necessitate further cleaning as heretofore specified. When the work area passes The Consultant's re-occupancy inspection, controls established in 3.1.1.6 will be removed. Additional air monitoring may be performed by the Consultant as a part of their occupancy clearance inspection. A final clearance level of 0.005 fibers/cc of air or less shall be obtained before re-occupancy.

RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

When cleanup is complete.

Relocate objects moved to temporary locations in the course of the work to their proper positions.

Re-secure HVAC, mechanical, and electrical systems in proper working order. Install new filters and disposal of used filters as contaminated waste.

DISPOSAL OF ASBESTOS-CONTAINING MATERIALS AND ASBESTOS-CONTAMINATED WASTE

As the work progresses and to prevent exceeding available storage capacity on site, remove sealed and labeled containers of asbestos waste and dispose of such containers at an authorized disposal site in accordance with the requirements of disposal authority. Submit documentation regarding disposal to building owner.

Sealed plastic bags must be dumped in the burial site unless the bags have been broken or damaged. Damaged bags must remain in the sealed drum and the entire contaminated drum must be buried. Uncontaminated drums may be recycled. Workers handling waste materials shall wear appropriate protective clothing and respirators.

All wastewater shall be filtered and disposed of in a manner acceptable with all regulations

AIR MONITORING AND ANALYSIS

The Consultant is responsible for air monitoring and visual inspections of the Shower Area, Clean Room, adjacent air locks and any areas surrounding the work area that may become contaminated by asbestos debris. The Consultant shall also be responsible for the initial clearance testing. Results of the final clearance testing shall be submitted to the EMUHSD.

The Consultant is responsible for conducted air monitoring of building and ambient air adjacent to control areas where building occupants or the public may be exposed to asbestos. This would include air monitoring of the negative air pressure equipment's exhaust.

Should the work area fail to meet the standard criteria for clearance, the area shall be re-cleaned and tests conducted until clearance has been achieved.

Documentation of air sampling must include as a minimum: Calculations of minimum sample volume to achieve necessary detection limits; sampling times; sampling locations (with appropriate diagrams); evidence of periodic inspection of sampling equipment; documentation of pre and post calibration of equipment; detailed description of work conditions; description of worker protective devices; and a description of any atypical environmental conditions.

Documentation of sample analysis must include as a minimum: Sample identification; total sample duration; sample flow rate; total air volume; total fibers counted (with work sheets); total fields counted; blank filter analysis; reticule field area; and fiber concentration in fibers per cubic centimeter. Analytical results must include calculation of detection limits as given in Appendix G of Environmental Protection Agency Publications EPA 560/55-83-002, March 1983, Guidance for Controlling Friable Asbestos-Containing Materials in Buildings:

DL = (10 fibers/100 fields/V) (FA/MFA) (1 liter/1000 cm3)

Where: DL= detection limit in fibers/cubic centimeter

V= Volume of air sampled in liters

FA= effective collecting area of the filter in square millimeters (typically 385 mm2 for 25 mm filters)

MFA= microscopic field area in square millimeters (typically 0.00785 mm2)

Air monitoring schemes, and inspections shall be conducted under the supervision of Consultant. This professional must be knowledgeable and responsible for Evaluation of Worker Protection Equipment and Procedures.

Air sampling analysis must be performed by individuals trained in the National Institute for Occupational Safety and Health (NIOSH) 582 course on Asbestos Air Sampling and Analysis. Sample analysis shall be conducted by a non-biased laboratory proficient participant in the NIOSH Proficiency Analytical Testing Program (PAT) for Asbestos and California DHS certified. An individual is a proficient participant in NIOSH PAT program if the individual is directly involved in submission of samples to NIOSH or is included in the quality control program for a proficient laboratory.

Lead Work Specifications

PART 1 GENERAL

1.1 SCOPE-The purpose of this specification is to minimize lead exposure to El Monte Union High School District (EMUHSD), students, visitors and staff, during removal of building materials that contain lead.

1.2 DESCRIPTION OF WORK

1.2.1.1 The work specified herein shall be abatement of lead containing material by contract with persons knowledgeable, qualified, and certified in the removal, treatment, handling, and disposal of lead -containing material, and the subsequent cleaning of the affected environment, who comply with Federal and State Regulations which mandate work practices, and who are capable of performing the work of this contract.

1.2.1.2 The lead removal contractor shall supply all labor, materials, equipment, services, insurance, and incidentals which are necessary or required to perform the work in accordance with applicable governmental regulations and these specifications. Insurance includes automotive, general, environmental pollution and workers' compensation insurance.

1.3 TERMINOLOGY

1.3.1 Building Owner- The EMUHSD.

1.3.2 Authorized Visitor- The building owner, Consultant, and any representative of a regulatory or another agency having jurisdiction over the project.

1.3.3 Abatement-Procedures to control lead release from lead-containing building materials.

1.3.4 Removal-All herein specified procedures necessary to remove lead containing materials from the designated areas and to dispose of these materials at an acceptable site.

1.3.7 Air Monitoring- The process of measuring the lead content of a specific volume of air in a stated period of time.

1.3.8 HEPA Vacuum Equipment- Vacuuming equipment with a HEPA filter system.

1.3.9 HEPA Filter- A high efficiency particulate absolute (HEPA) filter capable of trapping and retaining 99.97 percent of lead particles

1.3.10 Airlock- A system for permitting ingress and egress with minimum air movement between a contaminated area and an uncontaminated area.

1.3.11 Curtained doorway- A device to allow ingress or egress from one room to another while permitting minimal air movement between the rooms, typically constructed by placing two overlapping sheets of plastic over an existing or temporarily framed doorway, securing each along the top of the doorway, securing the vertical edge of one sheet along one vertical side of the doorway, and securing the vertical side of the doorway.

1.3.13 Decontamination Enclosure System- A series of connected rooms, with curtain doorways between any two adjacent rooms, for the decontamination of workers and of materials and equipment. A decontamination enclosure system always contains at least one airlock.

1.3.14 Worker Decontamination Enclosure System- That portion of a decontamination enclosure system designed for controlled passage of workers, and other personnel and authorized visitors, typically consisting of a clean room, a shower room, and an equipment room.

1.3.15 Equipment Decontamination Enclosure- That portions of a decontamination enclosure system designed for controlled transfer of materials and equipment, typically, consisting of a washroom and a holding area.

1.3.16 Clean Room- An uncontaminated area or room which is a part of the worker decontamination enclosure with provisions for storage of workers' street clothes and protective equipment.

1.3.17 Shower Room- A room between the clean room and the equipment room in the worker decontamination enclosure with hot and cold or warm running water and suitable arranged for complete showering during decontamination. The shower room comprised an airlock between contaminated clothing and equipment.

1.3.18 Washroom- A room between the work area and the holding area in the equipment decontamination enclosure system. The washroom comprised an airlock.

1.3.19 Holding Area- A chamber in the equipment decontamination enclosure located between the washroom and an uncontaminated area. The holding area comprises an airlock.

1.3.20 Fixed Object- A unit of equipment or furniture in the work area which can be removed from the work area.

1.3.21 Wet Cleaning- The process of eliminating lead contamination from building surfaces and objects by using cloths, mops, or other cleaning tools which have been dampened with water, and by afterwards disposing of these cleaning tools as Lead contaminated waste.

1.3.22 Negative Air Pressure Equipment- A portable local exhaust system equipped with HEPA filtration and capable of maintaining a constant, low velocity air flow into contaminated areas from adjacent uncontaminated areas.

1.3.23 Plasticize- To cover floors and walls with plastic sheeting as herein specified.

1.3.24 Work Area- Designated rooms, spaces, or areas of the project in which actions are to be undertaken or which may become contaminated as a result of such abatement actions. A contained work area is a work area which has been sealed, plasticized, and equipped with a decontamination enclosure system. A non-contained work area is an isolated or controlled-access work area which has not been plasticized nor equipped with decontamination enclosure system.

1.3.25 Lead painted components containment Technique- Utilizing duct tape, spray poly or polyethylene sheets to contain loose and peeling paint prior to, during and after removal

1.3.26 Consultant/ Sampling Professional-The professional contracted or employed to supervise monitoring and analysis schemes. This individual is also responsible for recognition of technical deficiencies in worker protection equipment and procedures during both planning and on-site phases of an abatement project. This individual should have specialized experience.

1.3.27 Paint stabilization includes installation of localized six mil polyethylene sheeting drops under the area to be stabilized to contain all dust and pain chips; use of scrapers with light water mist to remove loose and peeling paint;

treating the stabilized surface with an approved primer/sealer, and collecting all waste utilizing wet cleaning methods/HEPA vacuums and removing from the site for appropriate testing and disposal. Ambient air and surface dust wipe clearance testing may be conducted by the District's consultant.

1.4 APPLICABLE DOCUMENTS (References)-The current issue of each document shall govern. Where conflict among requirements or with these specifications exists, the more stringent requirements shall apply.

1.4.1 Regulations- Comply with applicable Federal, State, and local regulations.

1.4.1.2 Title 29, Code of Federal Regulations, Section 1910.1001. and Section 1926.1101. Occupational Safety and Health Administration (OSHA), US Department of Labor.

1.4.1.3 Title 40, Code of Federal Regulations, Part 61, Subparts A and B, National Emission Standards for Hazardous Air Pollutants. US Environmental Protection Agency (EPA).

1.4.1.4 South Coast Air Quality Management District

1.4.1.5 All State, County, and City codes and ordinances as applicable.

1.5 SUBMITTALS AND NOTICES

1.5.1 Prior to Commencement of Work

1.5.1.1 The Lead Abatement Contractor shall make required notifications to Cal OSHA as required

1.5.1.2 The Lead Abatement Contractor shall submit written notice to SCAQMD of proposed abatement work as required

1.5.1.3 Post caution signs in and around the work area to comply with regulations.

1.5.1.4 EMUHSD and the lead abatement contractor must agree on building and fixture condition prior to commencement of work.

1.5.1.5 Manufacturer's certification that vacuums, negative air pressure equipment, and other local exhaust ventilation equipment conform to ANSI 29.2-79 and SCAQMD requirements

1.6 PERSONNEL PROTECTION

1.6.1 Prior to commencement of work, the workers shall be instructed, and shall be knowledgeable, in emergency evacuation and evacuation procedures as needed prior to commencement of work.

1.6.2 All respiratory protection shall be provided to workers in conjunction with a respiratory protection program which shall meet the requirements of applicable regulations. This program shall be posted at the work site.

1.6.3 Provide workers with personally issued and marked respiratory equipment approved by The National Institute for Occupational Safety and Health (NIOSH).

1.6.4 Respiratory protection shall be worn by all persons potentially exposed to lead from the initiation of the lead demolition project until all areas have been given clearance. Clearance shall be obtained by visual inspection and/ or dust wipes as needed.

1.6.4.1 All lead workers entering the Work Area after commencement of lead removal shall wear appropriate respirators. Respirators shall be required until gross lead containing materials removal and until the areas have passed clearance tests.

1.6.4.2 If required, compressed air systems shall be designed to provide air volumes and pressures to accommodate respirator manufacturer's specifications. The compressed air systems shall have a receiver of adequate capacity to allow escape of all respirator wearers from contaminated area in the event of compressor failure. Compressors must meet the requirements of 29 CFR 1910.134(d). Compressors must have an in-line carbon monoxide monitor, and periodic inspection of the carbon monoxide monitor must be evidenced. Documentation of adequacy of compressed air system/respiratory protection system must be retained on site. This documentation will include a list of compatible components with the maximum number and type of respirators that may be used with the system. Periodic testing of compressed air shall insure that systems provide air of sufficient quality.

1.6.4.3 The minimum type of respiratory protection to be used for protection from lead during work in areas other than 1.6.4.1 is the Negative Air Purifying Respirator with High Efficiency (HEPA) Filtration.

1.6.4.4 Provide authorized visitors with suitable respirators and respiratory training whenever they are required to enter the work area to a maximum of 4 per day.

1.6.5 Provide workers with sufficient sets of protective full body clothing. Such clothing shall consist of full body coveralls and headgear. Provide eye protection and hard hats as required by applicable safety Regulations. Disposable type protection clothing, headgear, and footwear may be provided.

1.6.6 Provide authorized visitors with suitable protective clothing, headgear, eye protection, and footwear, as described in Section 1.6.4, whenever they are required to enter the work area, to a minimum of 4 sets per shift.

1.6.7 Provide and post, in the Equipment Room and the Clean Room, the decontamination and work procedures to be followed by workers, as described in Section 1.6.8 of these specifications.

1.6.8 Worker Protection Procedures

1.6.8.1 When practicable, each worker and authorized visitor shall, upon entering the job sites: remove street clothes in the clean changed room and put on a respirator and clean protective clothing before entering the Equipment Room or Work Area.

1.6.8.2 All workers and authorized visitors shall, each time they leave the Work Area: remove gross contamination from clothing before leaving the Work Area; proceed to the Equipment Room and remove all clothing except respirators; still wearing respirator proceed naked to the showers; clean the outside of the respirator with soap and water while showering; remove the respirator; thoroughly shampoo and wash themselves.

1.6.8.3 Following showering and drying off, each worker and authorized visitor shall proceed directly to the clean change room and dress in clean clothes at the end of each day's work, or before eating, smoking, or drinking. Before reentering the Work Area from the clean changed room, each worker and authorized visitor shall put on a clean respirator and shall dress in clean protective clothing.

1.6.8.4 Contaminated work footwear shall be stored in the Equipment Room when not in use in the Work Area. Upon completion of Lead abatement, dispose of footwear as contaminated waste.

1.6.8.5 Workers removing waste containers from the Equipment Decontamination Enclosure shall enter the Holding Area from outside wearing a respirator and dressed in clean disposable coveralls. No worker shall use this system as a means to leave or enter the Washroom or the Work Area.

1.6.8.6 Workers shall not eat, drink, smoke, or chew gum or tobacco while in the Work Area.

1.7 EQUIPMENT REMOVAL PROCEDURES

1.7.1 Clean surfaces of contaminated containers and equipment thoroughly by wet sponging or wiping before moving such items into the Equipment Decontamination Enclosure System Washroom for final cleaning and removal to uncontaminated areas. Ensure that personnel do not leave the Work Area through the Equipment Decontamination Enclosure.

1.8 BUILDING PROTECTION

PART 2-MATERIALS AND EQUIPMENT

2.1 MATERIALS

2.1.1 Deliver all materials in the original packages, containers, or bundles bearing the name of the manufacturer and the brand name.

2.1.1.2 Store all materials subject to damage off the ground away from wet or damp surfaces, and under cover sufficient to prevent damage or contamination.

2.1.1.3 Damaged or deteriorating materials shall not be used and shall be removed from the premises and properly disposed of.

2.1.2 Plastic (polyethylene) sheet, of 4-mil thickness or greater as specified, in sized to minimize the frequency of joints.

2.1.3 Tape- capable of sealing joints of adjacent sheets of plastic sheets and for attachment of plastic sheet to finished or unfinished surfaces of dissimilar materials and capable of adhering under both dry and wet conditions, including use of amended water.

2.1.4 Impermeable containers- suitable to receive and retain any lead-containing or contaminated materials until disposal at an acceptable disposal site. (The containers shall be labeled in accordance with OSHA Regulation 29 CFR 1910.1200(f)). Containers must be both air and watertight and allow for view of the contents

2.1.5 Warning labels and signs- as required by OSHA Regulation 29 CFR 1926.1101(k)(7)(iii).

2.1.6 Spray or trowel applied fire resistant materials- ULI labeled and listed Lead-free (mineral/fiber) (cementitious) material to provide the degree of fire protection required by the applicable building code.

2.1.7 Spray or trowel-applied thermal or acoustical insulation material used for patching or replacement must provide performance characteristics equivalent to or better than original material.

2.2 TOOLS AND EQUIPMENT (As applicable)

2.2.1 Provide suitable tools for lead abatement.

2.2.1.1 Negative air pressure equipment- High efficiency particulate absolute (HEPA) filtration systems shall be

equipped with filtration equipment in compliance with ANSI 29.2-79, local exhaust ventilation. No air movement system or air filtering equipment shall discharge unfiltered air outside the Work Area.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Work Areas: (As applicable)

3.1.1.1 Shut down and tag out electric power and natural gas prior to working on any affected equipment. If required, provide temporary power and lighting and ensure safe installation of temporary power sources and equipment per applicable electrical code requirements.

3.1.1.2 Shut down and isolate heating, cooling, and ventilating air systems to prevent contamination and fiber dispersal to other areas of the structure. During the work, vents within the Work Area shall be sealed with tape and plastic sheeting.

3.1.1.3 Pre-clean movable objects within the proposed work areas using HEPA vacuum equipment and/or wet cleaning methods as appropriate, and remove such objects from work areas to a temporary location. Where scheduled to be removed, carpeting shall be disposed of as contaminated material.

3.1.1.4 Pre-clean fixed objects within the proposed work areas, using HEPA vacuum equipment and/or wet cleaning methods as appropriate, and enclose within minimum 4 mil plastic sheeting sealed with tape.

3.1.1.5 Clean the proposed work areas using HEPA vacuum equipment or wet cleaning methods as appropriate. Do not use methods that raise dust, such as dry sweeping or vacuuming with equipment not equipped with HEPA filters.

3.1.1.6 Seal off all openings, including but not limited to windows, corridors, doorways, skylights, ducts, grills, diffusers, and any other penetrations of the work areas, with plastic sheeting (minimum of 4 mils thick) sealed with tape. Doorways and corridors which will not be used for passage during work, must be sealed with barriers as described in 3.1.2.4.

3.1.1.7 Depending on project requirements, cover floor and wall surfaces with plastic sheeting sealed with tape. Use a minimum of two layers of 6 mil plastic on floors and two layers of 4 mil plastic on walls. Cover floors first so that plastic extends at least 12 inches up on walls, then cover walls with plastic sheeting to the floor level, thus overlapping the floor material by a minimum of 12 inches.

3.1.1.8 Provide airlocks at entrances to and exits from the work areas.

3.1.1.9 Remove and clean ceiling mounted objects, such as lights and other items not previously sealed off, that interfere with lead work. Use handheld water spraying or HEPA vacuum equipment during fixture removal to reduce dust dispersal. See paragraph for work by other trades.

3.1.1.10 Maintain emergency and fire exits from the work areas, or establish alternative exits satisfactory to fire officials.

3.1.1.11 When applicable, after preparation of work areas and decontamination enclosure systems, remove ceiling (panels and tiles) within the work areas progressively and carefully, (clean using HEPA vacuum equipment and damp sponge and wrap clean (panels and tiles) in 4 mil minimum thickness plastic and store in building as directed by building owner and dispose of as contaminated waste,

3.1.1.12 Where suspended ceiling suspension systems, such as T-grids, must be removed to expose and make work areas accessible, clean T-grid using wet methods, disconnect grid from hangers, wrap cleaned grid members in 4 mil. minimum thickness plastic and store as directed by building owner or dispose of T-grid members as contaminated waste.

3.1.1.13 Where removal of suspended ceiling grid suspension systems is not required for work area accessibility, leave the grid system in place and, upon completion of the abatement work, clean the grid system as specified in 3.5.

3.1.1.14 After preparation of work areas and decontamination enclosure systems, remove plaster ceilings, including lath, furring channel system (grid), wire ties, clips, screws, and other accessory items and dispose of as contaminated waste. Spray ceiling debris and the immediate work area with amended water to reduce dust as the work progresses.

3.1.2 Decontamination Enclosure systems:

3.1.2.1.1 Build suitable framing as described herein and approved by the architect at shop drawing submittal stage. Portable prefab units, if utilized, must be submitted for review and approval by the architect before start of construction. Submittal shall include, but not be limited to, a floor plan layout complying with schematic layout bound herein, showing dimensions, materials, sizes, thickness, plumbing, and electrical outlets, etc.

3.1.2.1.2 In all cases access between contaminated and uncontaminated rooms or areas shall be through an airlock as described in Section 1.3. In all cases, access between any two rooms within the decontamination enclosure systems shall be through a curtained doorway.

3.1.2.2 Worker Decontamination Enclosure: As required, construct a workers decontamination enclosure system contiguous to the work area consisting of three totally enclosed chambers to conform as follows.

3.1.2.2.1 An Equipment Room with two curtained doorways, one to the work area and one to the shower rooms.

3.1.2.2.2 A Shower Room with two curtained doorways, one to the equipment room and one to the clean room. The Shower Room shall contain at least one shower with hot and cold or warm water. Careful attention shall be paid to the shower enclosure to ensure against leaking of any kind. Ensure a supply of soap and disposable towels at all times in the shower room.

3.1.2.2.3 A Clean Room with one curtained doorway into the shower and one entrance or exit to non-contaminated areas of the building. The Clean Room shall have sufficient space for storage of the worker's street clothes, towels, and other non-contaminated items. Joint use of this space for other functions, such as offices, storage of equipment, materials, or tools, shall be prohibited.

3.1.2.3 Equipment Decontamination Enclosure: Provide or construct an Equipment Decontamination Enclosure system consisting of two totally enclosed chambers as follows:

3.1.2.3.1 A Washroom, constituting an airlock, with a curtained doorway to a designated staging area of the Work Area and a curtained doorway to the holding area.

3.1.2.3.1 A Holding Area, constituting an airlock, with a curtained doorway to the Washroom, and a curtained doorway to an uncontaminated area.

3.1.2.4 Separation of work areas from occupied areas.

3.1.2.4.1 Separate parts of the building required to remain in use from parts of the building that will undergo Lead abatement by means of airtight barriers, constructed as follows:

3.1.2.4.1 Build suitable wood or metal framing and apply 3/8" minimum thickness sheathing on work side only unless noted otherwise.

3.1.2.4.1.2 Cover both sides of partition with double layer of plastic sheet with joints staggered and sealed with tape. Edges of partition at floor, walls, and ceiling shall be caulked airtight.

3.1.2.5 Maintenance of Enclosure systems:

3.1.2.5.1 Ensure that barriers and plastic linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.

3.1.2.5.2 Visually inspect enclosures at the beginning of each work period.

3.1.2.5.3 Use smoke methods to test effectiveness of barriers when directed by architect/engineer/consultant.

3.1.2.6 Lead abatement work shall not commence until:

3.1.2.6.1 Arrangements have been made for disposal of waste at an acceptable site.

3.1.2.6.2 Work Areas and decontaminated enclosure systems and parts of the building required to remain in use are effectively segregated.

3.1.2.6.3 Tools, equipment, and material waste receptors are on hand.

3.1.2.6.4 Arrangements have been made for building security.

3.1.2.6.5 All other preparatory steps have been taken and applicable notices posted and permits obtained.

3.1.2.6.6 All worker training has been completed and documentation is on site.

3.1.2.6.7 Abatement work will not begin until the consultant has authorized work to commence.

3.2 LEAD REMOVAL

3.2.1 Prepare site (see section 3.1)

3.2.2 Spray lead material with water, using spray equipment capable of providing a "mist" application to reduce the release of particles. Mist the material sufficiently to wet it without causing excess dripping. Spray the lead material repeatedly during work process to maintain wet condition and to minimize lead dust dispersion.

3.2.3 In order to maintain indoor Lead concentrations at a minimum, the misted lead materials must be removed in manageable sections. Material shall not be allowed to dry out.

3.2.4 Seal filled containers. Place caution labels on containers in accordance with OSHA Regulation if not already preprinted on containers. Clean external surfaces of containers thoroughly by wet sponging in the designated area. Move containers to the washroom, wet clean each container thoroughly, and move to holding area pending removal to uncontaminated areas. Ensure that containers are removed from the holding area by workers who have entered from uncontaminated areas dressed in clean coveralls. Ensure that workers do not enter from uncontaminated areas into the washroom or the work area; ensure that contaminated workers do not exit the work area through the Equipment Decontamination Enclosure System.

3.2.5 After completion of lead work, all surfaces from which lead has been removed shall be wet brushed and

sponged or cleaned by an equivalent method to remove all visible material. During this work, the surfaces being cleaned shall be kept wet.

3.2.6 After substrate is dry and is visibly free of lead materials and before plastic sheeting is removed, conduct several cycles of HEPA vacuuming alternating with wet wiping until surfaces are below acceptable levels of lead dust contamination.

3.2.7 Clean up shall be in accordance with Section 3.5.

2.3.8 If at any time during the removal air testing or visual inspections indicate contamination of areas outside the work area, immediate steps shall be taken by the contractor to decontaminate these areas. Unprotected individuals shall be prohibited from entering contaminated areas until air sampling and visual inspections certify decontamination.

CLEANUP

Remove visible accumulations of lead material and debris. Wet clean all surfaces within the work area.

Remove the cleaned outer layer of plastic from walls and floors. The windows, doors, and HVAC vents shall remain sealed and any HEPA filtration negative air pressure systems and decontamination enclosure systems shall remain in service.

After cleaning the work area, wait at least 2 hours to allow for the settlement of dust, and again wet clean or clean with HEPA vacuum equipment all surfaces in the work area. After completion of the second cleaning operation, perform a complete visual inspection of the work area to ensure that the work area is free of contamination.

Sealed drums and all equipment used in the work area shall be included in the cleanup and shall be removed from work areas, via the Equipment Decontamination Enclosure at an appropriate time in the cleaning sequence.

If the building owner finds visible accumulations of dust in the work area, the contractor shall repeat the wet cleaning until the work area is in compliance, at the contractor's expense.

INITIAL CLEARANCE TESTING

Upon notice from contractor that work areas and all other contaminated and cleaned areas area ready for initial clearance testing. The Consultant shall test for the Standard of Cleaning
Areas which do not comply with the Standard for Cleaning for Initial Clearance shall continue to be cleaned by and at the contractor's expense until the specified Standard of Cleaning is achieved as evidenced by results of dust/ contamination testing as previously specified.

After initial clearance, if applicable, the final layer of plastic may be removed by workers with proper respiratory protection. However, controls established in 3.1.1.6 may not be removed at this point.

RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

When cleanup is complete.

Relocate objects moved to temporary locations in the course of the work to their proper positions.

Re-secure HVAC, mechanical, and electrical systems in proper working order. Install new filters and disposal of used filters as contaminated waste.

DISPOSAL OF LEAD-CONTAINING MATERIALS AND LEAD-CONTAMINATED WASTE

As the work progresses and to prevent exceeding available storage capacity on site, remove sealed and labeled containers of lead waste and dispose of such containers at an authorized disposal site in accordance with the requirements of disposal authority. Submit documentation regarding disposal to building owner.

Sealed plastic bags must be dumped in the burial site unless the bags have been broken or damaged. Damaged bags must remain in the sealed drum and the entire contaminated drum must be buried or incinerated. Uncontaminated drums may be recycled. Workers handling waste materials shall wear appropriate protective clothing and respirators.

All wastewater shall be filtered and disposed of in a manner acceptable with all regulations

AIR MONITORING, CLEARANCE DUST WIPE TESTING AND ANALYSIS

The Contractor is responsible for personal air monitoring and visual inspections of the Shower Area, Clean Room, adjacent air locks and any areas surrounding the work area that may become contaminated by lead debris. The Consultant shall be responsible for clearance dust wipe testing. Results of the final clearance testing shall be submitted to the EMUHSD.

Should the work area fail to meet the standard criteria for clearance, the area shall be re-cleaned and tests conducted until clearance has been achieved.

Air sampling analysis must be performed by individuals suitably trained.

Sample analysis shall be conducted by a non-biased laboratory proficient in Lead analyses with an ELLAP, and CDPH accreditation.

EXHIBIT “F”

REPORT OF PAINT SAMPLING FOR LEAD

ENVIRONMENTAL ASSISTANCE GROUP
179 NIBLICK ROAD #401 PASO ROBLES CA. 93446
PHONE/FAX 805-286-4921 E-MAIL comply@haztrainer.com

REPORT
of
PAINT SAMPLING FOR LEAD

Conducted at

ROSEMEAD HIGH SCHOOL
9063 E. MISSION DRIVE
ROSEMEAD, CALIFORNIA 91770

Prepared for

MS. NORMA MACIAS
DIRECTOR OF FACILITIES, MAINTENANCE, OPERATIONS and TRANSPORTATION
EL MONTE UNION HIGH SCHOOL DISTRICT
4921 N. CEDAR AVENUE EL MONTE, CALIFORNIA 91732

Prepared by

ENVIRONMENTAL ASSISTANCE GROUP,
179 Niblick Road # 401
Paso Robles Ca. 93446

Project Number: MEHR120

January 16, 2020

Report generated by

Eldwin “Ed” Kennedy, CAC # 93-1429 CLP # 4092
President
Environmental Assistance Group

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

REPORT OF LEAD PAINT SAMPLING

INTRODUCTION

On May 2, 2020, Environmental Assistance Group represented by Ed Kennedy, collected samples of suspect lead containing paint at Rosemead View High School in the El Monte Union High School District. The sampling was requested by Mr. Jorge Estrada, Maintenance Coordinator for El Monte Union High School District (EMUHSD). The sampling was requested because the District plans to repaint twelve buildings at the High School. Forty-three representative samples were collected from the buildings to determine which building components might have paint considered to be lead based paint (LBP) and require specified work practices with lead trained workers.

METHOD

Each side and component of each building was inspected for locations and condition of painted surfaces. Different colors of paint were identified and sampled and then samples considered to be representative of all paint of that color on each component of each building. Primarily, samples of paint were collected from areas of deteriorated or damaged paint with the intent of collecting all layers down to the substrate. The sampling method included scraping and/or peeling off paint samples of approximately four-square inches. The samples were placed in containers and transported to an AIHA-LAP, LLC Accreditation, Lab ID # 101629 and DHS certified laboratory, Forensic Analytical in Dominguez Hills California, for analysis by Flame Atomic Absorption. A chain of custody was attached to the sample submittal sheets. After analysis, a report of analyses results was provided for inclusion in this report.

RESULTS

Of the forty-three paint samples, twenty-three showed lead content and seven of those are considered LBP under the Los Angeles County Department of Health Services threshold of 0.06 % by weight. OSHA requires air borne lead assessment for any detectable level of lead.

RECOMMENDATIONS

Utilize the services of a Certified Lead Project Designer to develop a scope of work and specifications for Paint Stabilization of lead containing painted services on buildings throughout the campus. Trained and Certified Lead Workers should be used to conduct the work where samples have indicated homogeneous areas of painted components contain Lead.

II. LEAD SAMPLING FORM

LEAD SAMPLING FORM

Environmental Assistance Group
179 Niblick Rd. #401
Paso Robles, CA 93446
Office: 805-286-4921

CLIENT: MERGE

DATE: 1-16-20 SITE: Rosemead High School PROJECT # MEHRL120

SAMPLED: 1-16-20 LEAD CERT #: 4092

INSPECTOR: Eldwin "Ed" Kennedy Signature: Eldwin E Kennedy

SAMPLE #	HOMOGENOUS MATERIAL	CONDITION	LOCATION/ SURFACE	BLDG/ SUITE	RM/#	SAMPLE LOCATION	AMT
MEHRL120-1	Red/white paint Red on lower 4'	Damaged/ deteriorated	Wall of concrete pier	Admin	Exterior E. end	4' up on E. face, 6" up	0.007
MEHRL120-2	White paint	Damaged/ deteriorated	Ceiling of covered entry	Admin	Exterior W. end	4' from S. wall, 8' from E. edge	<0.006
MEHRL120-3	White paint on texture coat	Damaged/ deteriorated	Texture coat wall	40's H Bldg.	Exterior W. end	46' from S. corner, 1' up on Rm. 41	<0.006
MEHRL120-4	White paint on texture coat, red on lower 4'	Damaged/ deteriorated	Wall outside restroom	40's H Bldg.	Outside Maint.	South building. 35' from N corner. 8' up	<0.006
MEHRL120-5	White paint over gray, red on lower 4'	Damaged/ deteriorated	Wall of Hazmat Storage	40's H Bldg.	Hazmat	W. wall 5' up, 6' from N. corner	<0.006
MEHRL120-6	White paint on windowsill	Damaged/ deteriorated	Wall of Maint. Shop, N. side	40's H Bldg.	Maint. Exterior	2' from N.W. corner	**2**
MEHRL120-7	White paint over stucco, red on lower 4'	Damaged/ deteriorated	Red painted section of wall	40's H Bldg.	W. exterior of 44	W. side, 4' from S.W. corner, 2' up	<0.006
MEHRL120-8	White paint	Damaged/ deteriorated	Wall – N. side	40's H Bldg.	Outside 45	3' from N.E. corner, 2' up	<0.008
MEHRL120-9	Red paint lower 4', red top	Damaged/ deteriorated	Wall – S. side	40's H Bldg.	Outside 45	2' up, 15' from S.W. corner	0.012
MEHRL120-10	White paint over gray & green	Damaged/ deteriorated	Window frame on boarded window opening	40's H Bldg.	Outside 45	W. side frame & plywood, 2' up	**0.67**
MEHRL120-11	White and red paint (lower 4')	Damaged/ deteriorated	Walls W. side	90's	Outside 90	15' from S.W. corner, 4' up	<0.006
MEHRL120-12	White paint, red bottom 4'	Damaged/ deteriorated	Frames of windows, W. end, sills/ plywood	90's	Outside 93	N. side windows, lower sill center	0.030
MEHRL120-13	Red paint	Damaged/ deteriorated	On metal door	90's	Outside 93	Lower	**0.075**
MEHRL120-14	White paint	Damaged/ deteriorated	Wall – N. side	90's	Outside 95	20' from N.E. corner, 4' up	0.009
MEHRL120-15	White paint	Damaged/ deteriorated	On metal electrical panel J box	90's	Outside 95	20' from N.W. corner, 6' up	<0.006

LEAD SAMPLING FORM

Page 2 of 3

Environmental Assistance Group
179 Niblick Rd. #401
Paso Robles, CA 93446
Office: 805-286-4921

CLIENT: MERGE

DATE: 1-16-20 SITE: Rosemead High School PROJECT # MEHRL120

SAMPLED: 1-16-20 LEAD CERT #: 4092

INSPECTOR: Eldwin "Ed" Kennedy Signature: Eldwin E Kennedy

SAMPLE #	HOMOGENOUS MATERIAL	CONDITION	LOCATION/ SURFACE	BLDG/ SUITE	RM/#	SAMPLE LOCATION	AMT
MEHRL120-16	Red paint, red on lower wall	Damaged/ deteriorated	On wall, W. side of bldg.	90's	Outside 99	6" from N. corner, 2' up	**0.072**
MEHRL120-17	White paint, red on lower wall	Damaged/ deteriorated	On wall, W. side of bldg.	90's	Outside 99	4' from N. corner, 5' up	0.017
MEHRL120-18	Red paint	Damaged/ deteriorated	On metal, N. door of 99	90's	Outside 99	Top door jamb 4" from N. side	**0.11**
MEHRL120-19	White paint	Damaged/ deteriorated	Walls over T 1-11	115 Port-able	Outside 115	N. wall, 15' from W. corner, 2' up	<0.006
MEHRL120-20A	Red paint	Damaged/ deteriorated	On metal door	115	115	At damage	<0.006
MEHRL120-20	White paint, red on lower 4'	Damaged/ deteriorated	Stucco on walls	60's	Outside 68/ Women's RR	E. wall, 4' from N.E. corner, 8' up	0.02
MEHRL120-21	White & red paint, red on lower 4'	Damaged/ deteriorated	Stucco on walls, N. side	60's	Outside 64	22' from N. door, 4' up	<0.006
MEHRL120-22	Red paint	Damaged/ deteriorated	W. side	60's	Outside 62 & Boy's RR	28' from N.W. corner, 2' up	<0.006
MEHRL120-23	White paint, red on lower 4'	Damaged/ deteriorated	Wall, N. side	50's	Outside 56	5' from door, 5' up	0.008
MEHRL120-24	Red paint over metal	Damaged/ deteriorated	N. side door	50's	Outside 58	Adjacent middle hinge	<0.006
MEHRL120-25	Red paint	Damaged/ deteriorated	E. end wall	50's	Outside High Voltage Rm.	6' from S. corner, 3' up	0.010
MEHRL120-26	White paint, red on lower 4'	Damaged/ deteriorated	W. end wall	50's	Outside 51B	22' from S. W. corner, 5' up	<0.006
MEHRL120-27	White paint, red on lower 4'	Damaged/ deteriorated	S. side wall	Cafe/ Library	Outside Cafe	18' from S. cafe double doors, 6' up	0.015
MEHRL120-28	White paint, red on lower 4'	Damaged/ deteriorated	W. side wall	Cafe/ Library	Outside Kitchen	3' from speed line door, 4' up	0.007
MEHRL120-29	White paint over green wood	Damaged/ deteriorated	Window trim	Cafe/ Library	Outside Kitchen		**0.088**
MEHRL120-30	White paint, red on lower 4'	Damaged/ deteriorated	Wall	J2	Student Storage	Above door	0.007

LEAD SAMPLING FORM

Page 3 of 3

Environmental Assistance Group
179 Niblick Rd. #401
Paso Robles, CA 93446
Office: 805-286-4921

CLIENT: MERGE

DATE: 1-16-20 SITE: Rosemead High School PROJECT # MEHRL120

SAMPLED: 1-16-20 LEAD CERT #: 4092

INSPECTOR: Eldwin "Ed" Kennedy Signature: Eldwin E Kennedy

SAMPLE #	HOMOGENOUS MATERIAL	CONDITION	LOCATION/ SURFACE	BLDG/ SUITE	RM/#	SAMPLE LOCATION	AMT
MEHRL120-31	White paint, red on lower 4'	Damaged/ deteriorated	Wall, N. side	J2	Panther's Lair, outside	3' from N.W. corner, 7' up	<0.006
MEHRL120-32	White paint, red on lower 4'	Damaged/ deteriorated	Wall, S. side	Gym	Outside boy's lockers	5' from S.W. corner, 7' up	<0.006
MEHRL120-33	Red paint, white above	Damaged/ deteriorated	Wall, N. side	Gym	Outside boy's lockers	3' from N.E. corner, 3' up	<0.006
MEHRL120-33A	White paint	Damaged/ deteriorated	Wall, N. side	Gym	Outside boy's lockers	At damaged section	0.026
MEHRL120-34	Red & white paint	Damaged/ deteriorated	On block wall	Gym	Outside N.E. of Gym	Center of E. wall	<0.007
MEHRL120-35	White paint	Damaged/ deteriorated	On smooth poured concrete wall	Gym	Outside N. of gym	38' from N.E. corner of Gym, 4' up	0.024
MEHRL120-36	Red paint	Damaged/ deteriorated	On metal door jambs	Gym	Outside, N.W. Mechanical Rm.	On header jamb, center	0.029
MEHRL120-37	White paint	Damaged/ deteriorated	On cast iron drain pipe	Gym	Outside, N.W. Mechanical Rm.	3-5' up, adjacent door	**0.080**
MEHRL120-38	Red & white paint	Damaged/ deteriorated	On black wall	Gym	Girl's side of Gym, N.W. corner	From N. and W. walls near the N-W corner	<0.006
MEHRL120-39	White paint	Damaged/ deteriorated	Window components, W. wall	Gym	Outside girl's lockers	4th window from N.W. corner sill & window frame	**2**
MEHRL120-40	White paint	Damaged/ deteriorated	Wall on N. side	Band	Outside W. Band Rm.	6' from N.W. corner, 7' up – 3' up	0.013
MEHRL120-41	Red paint	Damaged/ deteriorated	Wall at E. end steps on smooth concrete	Band	Across from 80	Above S end of 3rd step	0.007

III. SURVEY RESULTS REPORT

SGS FORENSIC LABORATORIES

Final Report

Metals Analysis of Paints

(AIHA-LAP, LLC Accreditation, Lab ID #101629)

Environmental Assistance Group
Ed Kennedy
PO Box 2537

Tehachapi, CA 93561

Client ID: L1206
Report Number: M221239
Date Received: 01/16/20
Date Analyzed: 01/17/20
Date Printed: 01/17/20
First Reported: 01/17/20

Job ID / Site: MEHRL120; Rosemead HS
Date(s) Collected: 01/16/20

SGSFL Job ID: L1206
Total Samples Submitted: 43
Total Samples Analyzed: 43

Sample Number	Lab Number	Analyte	Result	Result Units	Reporting Limit*	Method Reference
MEHRL120 1	LM185331	Pb	0.007	wt%	0.006	EPA 3050B/7000B
MEHRL120 2	LM185332	Pb	< 0.006	wt%	0.006	EPA 3050B/7000B
MEHRL120 3	LM185333	Pb	< 0.006	wt%	0.006	EPA 3050B/7000B
MEHRL120 4	LM185334	Pb	< 0.006	wt%	0.006	EPA 3050B/7000B
MEHRL120 5	LM185335	Pb	< 0.006	wt%	0.006	EPA 3050B/7000B
MEHRL120 6	LM185336	Pb	10	wt%	2	EPA 3050B/7000B
MEHRL120 7	LM185337	Pb	< 0.006	wt%	0.006	EPA 3050B/7000B
MEHRL120 8	LM185338	Pb	0.008	wt%	0.006	EPA 3050B/7000B
MEHRL120 9	LM185339	Pb	0.012	wt%	0.006	EPA 3050B/7000B
MEHRL120 10	LM185340	Pb	0.67	wt%	0.03	EPA 3050B/7000B
MEHRL120 11	LM185341	Pb	< 0.006	wt%	0.006	EPA 3050B/7000B
MEHRL120 12	LM185342	Pb	0.030	wt%	0.006	EPA 3050B/7000B
MEHRL120 13	LM185343	Pb	0.075	wt%	0.006	EPA 3050B/7000B
MEHRL120 14	LM185344	Pb	0.009	wt%	0.006	EPA 3050B/7000B
MEHRL120 15	LM185345	Pb	< 0.006	wt%	0.006	EPA 3050B/7000B
MEHRL120 16	LM185346	Pb	0.072	wt%	0.006	EPA 3050B/7000B
MEHRL120 17	LM185347	Pb	0.017	wt%	0.006	EPA 3050B/7000B
MEHRL120 18	LM185348	Pb	0.11	wt%	0.006	EPA 3050B/7000B
MEHRL120 19	LM185349	Pb	< 0.006	wt%	0.006	EPA 3050B/7000B
MEHRL120 20	LM185350	Pb	< 0.02	wt%	0.02	EPA 3050B/7000B
MEHRL120 21	LM185351	Pb	< 0.006	wt%	0.006	EPA 3050B/7000B
MEHRL120 22	LM185352	Pb	< 0.006	wt%	0.006	EPA 3050B/7000B
MEHRL120 23	LM185353	Pb	0.008	wt%	0.006	EPA 3050B/7000B
MEHRL120 24	LM185354	Pb	< 0.006	wt%	0.006	EPA 3050B/7000B
MEHRL120 25	LM185355	Pb	0.010	wt%	0.006	EPA 3050B/7000B
MEHRL120 26	LM185356	Pb	< 0.006	wt%	0.006	EPA 3050B/7000B
MEHRL120 27	LM185357	Pb	0.015	wt%	0.006	EPA 3050B/7000B
MEHRL120 28	LM185358	Pb	0.007	wt%	0.006	EPA 3050B/7000B
MEHRL120 29	LM185359	Pb	0.088	wt%	0.006	EPA 3050B/7000B
MEHRL120 30	LM185360	Pb	0.007	wt%	0.006	EPA 3050B/7000B
MEHRL120 31	LM185361	Pb	< 0.006	wt%	0.006	EPA 3050B/7000B

2959 Pacific Commerce Drive, Rancho Dominguez, CA 90221 / Telephone: (310) 763-2374 (888) 813-9417 / Fax: (310) 763-8684

SGS FORENSIC LABORATORIES

Metals Analysis of Paints

(AIHA-LAP, LLC Accreditation, Lab ID #101629)

Environmental Assistance Group
Ed Kennedy
PO Box 2537

Tehachapi, CA 93561

Client ID: L1206
Report Number: M221239
Date Received: 01/16/20
Date Analyzed: 01/17/20
Date Printed: 01/17/20
First Reported: 01/17/20

Job ID / Site: MEHRL120; Rosemead HS
Date(s) Collected: 01/16/20

SGSFL Job ID: L1206
Total Samples Submitted: 43
Total Samples Analyzed: 43

Sample Number	Lab Number	Analyte	Result	Result Units	Reporting Limit*	Method Reference
MEHRL120 32	LM185362	Pb	< 0.006	wt%	0.006	EPA 3050B/7000B
MEHRL120 33	LM185363	Pb	< 0.006	wt%	0.006	EPA 3050B/7000B
MEHRL120 34	LM185364	Pb	< 0.007	wt%	0.007	EPA 3050B/7000B
MEHRL120 35	LM185365	Pb	0.024	wt%	0.006	EPA 3050B/7000B
MEHRL120 36	LM185366	Pb	0.029	wt%	0.006	EPA 3050B/7000B
MEHRL120 37	LM185367	Pb	0.080	wt%	0.006	EPA 3050B/7000B
MEHRL120 38	LM185368	Pb	< 0.006	wt%	0.006	EPA 3050B/7000B
MEHRL120 39	LM185369	Pb	11	wt%	2	EPA 3050B/7000B
MEHRL120 40	LM185370	Pb	0.013	wt%	0.006	EPA 3050B/7000B
MEHRL120 41	LM185371	Pb	0.007	wt%	0.006	EPA 3050B/7000B
MEHRL120 20A	LM185376	Pb	< 0.006	wt%	0.006	EPA 3050B/7000B
MEHRL120 33A	LM185377	Pb	0.026	wt%	0.006	EPA 3050B/7000B

* The Reporting Limit represents the lowest amount of analyte that the laboratory can confidently detect in the sample, and is not a regulatory level. The Units for the Reporting Limit are the same as the Units for the Final Results.

Beatriz Hinojosa, Laboratory Supervisor, Rancho Dominguez Laboratory

2959 Pacific Commerce Drive, Rancho Dominguez, CA 90221 / Telephone: (310) 763-2374 (888) 813-9417 / Fax: (310) 763-8684

Forensic Analytical Laboratories, Inc.

Analysis Request Form (COC)

Client Name & Address: Environmental Assistance Group, PO Box 2537, Tehachapi CA 93581

Client No.: L1206

PO / Job#: HEHRL120

Date: 1-16-20

Turn Around Time: Same Day / 1Day / 2Day / 3Day / 4Day / 5Day

☐ PCM: ☐ NIOSH 7400A / ☐ NIOSH 7400B ☐ Rotometer

☐ PLM: ☐ Standard / ☐ Point Count 400 - 1000 / ☐ CARB 435

Contact: Ed Kennedy

Phone: Office: 661-822-8762 Cell: 661-304-8981

Fax: 661-822-8762

☐ TEM Air: ☐ AHERA / ☐ Yamate2 / ☐ NIOSH 7402

☐ TEM Bulk: ☐ Quantitative / ☐ Qualitative / ☐ Chatfield

☐ TEM Water: ☐ Potable / ☐ Non-Potable / ☐ Weight %

☐ TEM Microvac: ☐ Qual(+/-) / ☐ Ds/Tbl(str/area) / ☐ Ds/Tbl(str/mass)

E-mail: compy@HazTrainer.com

☐ IAQ Particle Identification (PLM LAB) ☐ PLM Opacity/Spot

☐ Particle Identification (TEM LAB) ☐ Special Project

Technician: Eldwin Kennedy

CAC # 93-1429 CLP # A092

Metals Analysis: Methods: AA

Matrix: Bulk - Paintchips

Analytes: Lead

Site Location: Rosemead HS

Comments: 1 of 4

Report Via: ☐ Fax ☒ E-Mail ☐ Verbal

HA	Sample ID	Date / Time	Sample Location / Description	FOR AIR SAMPLES ONLY: Type	Time On/Off	Avg. LPM	Total Time	Sample Area / Air Volume
	MEHRL120 1	1-16-20		A P C				
	2	1-16-20		A P C				
	3			A P C				
	4			A P C				
	5			A P C				
	6			A P C				
	7			A P C				
	8			A P C				
	9			A P C				
	10			A P C				
	11			A P C				

Sampled By: Eldwin Kennedy Date: 1-16-20 Time:

Shipped Via: ☐ Fed Ex ☐ DHL ☐ UPS ☐ US Mail ☐ Courier ☒ Drop Off ☐ Other:

Relinquished By: Eldwin Kennedy	Relinquished By:	Relinquished By:
Date / Time: 1-16-20 4:30p	Date / Time:	Date / Time:
Received By:	Received By:	Received By:
Date / Time: 01 16 20 4:30PM	Date / Time	Date / Time
Condition Acceptable? ☒ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No

Forensic Analytical Laboratories, Inc.

Analysis Request Form (COC)

Client Name & Address: Environmental Assistance Group, PO Box 2457, Tehachapi CA 93581

Client No.: 2006

PO / Job#: HEHRL120 Date: 1-16-20

Turn Around Time: Same Day / 1Day / 2Day / 3Day / 4Day / 5Day

☐ PCM: ☐ NIOSH 7400A / ☐ NIOSH 7400B ☐ Rotometer

☐ PLM: ☐ Standard / ☐ Point Count 400 - 1000 / ☐ CARB 435

Contact: Ed Kennedy

Phone: Office: 661-822-8762 Fax:

Cell: 661-304-8981 661-822-8762

E-mail: comply@HazTrainer.com

☐ TEM Air: ☐ AHERA / ☐ Yamate2 / ☐ NIOSH 7402

☐ TEM Bulk: ☐ Quantitative / ☐ Qualitative / ☐ Chatfield

☐ TEM Water ☐ Potable / ☐ Non-Potable / ☐ Weight %

☐ TEM Microvac: ☐ Qual(+/-) / ☐ D5755(str/area) / ☐ D5756(str/mass)

☐ IAQ Particle Identification (PLM LAB) ☐ PLM Opaques/Soot

☐ Particle Identification (TEM LAB) ☐ Special Project

Technician: Eldwin Kennedy

CAC # 93-1429 CLP # 4092

☑ Metals Analysis: Method: AA

Matrix: Paint Chip Bulk

Analytes: Lead

Site Location: Rosemead HS

Comments: 2 of 4

Report Via: ☐ Fax ☒ E-Mail ☐ Verbal

NA	Sample ID	Date / Time	Sample Location / Description	FOR AIR SAMPLES ONLY: Type	Time On/Off	Avg. LPM	Total Time	Sample Area / Air Volume
	HEHRL-120 12	1-16-20		A P C				
	13			A P C				
	14			A P C				
	15			A P C				
	16			A P C				
	17			A P C				
	18			A P C				
	19			A P C				
	20			A P C				
	21			A P C				

Sampled By: Eldwin Kennedy Date: 1-16-20 Time:

Shipped Via: ☐ Fed Ex ☐ DHL ☐ UPS ☐ US Mail ☐ Courier ☒ Drop Off ☐ Other:

Relinquished By: Eldwin Kennedy	Relinquished By:	Relinquished By:
Date / Time: 1-16-20 4:30P	Date / Time:	Date / Time:
Received By:	Received By:	Received By:
Date / Time: 01/16/20 4:30pm	Date / Time:	Date / Time:
Condition Acceptable? ☐ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No

San Francisco Office: 3777 Depot Road, Suite 409, Hayward, California 94545-2761 / Ph: (510)887-8678 * (800)827-3274 / Fax: (510)887-4218
Los Angeles Office: 2959 Pacific Commerce Drive, Rancho Dominguez, California 90221 / Ph: (310)763-2374 * (866)813-9417 / Fax: (310)763-4450
Las Vegas Office: 6765 S. Eastern Avenue, Suite 3, Las Vegas, Nevada 89119 / Ph: (702)784-0040 / Fax: (702)784-0030

Forensic Analytical Laboratories, Inc.

Analysis Request Form (COC)

Client Name & Address: Environmental Assistance Group, PO Box 2547, Tehachapi CA 93581

Client No.: L1206

PO / Job#: MFHRL120

Date: 1-16-20

Turn Around Time: Same Day / (1Day) / 2Day / 3Day / 4Day / 5Day

☐ POM: ☐ NIOSH 7400A / ☐ NIOSH 7400B ☐ Rotometer

☐ PLM: ☐ Standard / ☐ Point Count 400 - 1000 / ☐ CARB 435

☐ TEM Air: ☐ AHERA / ☐ Yamate2 / ☐ NIOSH 7402

☐ TEM Bulk: ☐ Quantitative / ☐ Qualitative / ☐ Chatfield

☐ TEM Water: ☐ Potable / ☐ Non Potable / ☐ Weight %

☐ TEM Microvac: ☐ Qual(+/-) / ☐ D5755(#s/area) / ☐ D5756(gm/mass)

☐ TEM Particle Identification (PLM LAB) ☐ PLM Opaques/Soot

☐ Particle Identification (TEM LAB) ☐ Special Project

Contact: Ed Kennedy EK

Phone: Office: 661-822-8767 Cell: 661 304 8981

Fax: 661-822-8762

E-mail: comply@HazTrainer.com

Technician: Eldwin Kennedy

CAC # 93-1429 CLP # 4092

☒ Metals Analysis: Method: AA

Matrix: Bulk - Paint chips

Analytes: Lead

Site Location: Rosemead HS

Comments: 3 of 4

Report Via: ☐ Fax ☒ E-Mail ☐ Verbal

HA	Sample ID	Date / Time	Sample Location / Description	FOR AIR SAMPLES ONLY: Type	Time On/Off	Avg. LPM	Total Time	Sample Area / Air Volume
	MFHRL1022	1-16-20		APC				
	23			APC				
	24			APC				
	25			APC				
	26			APC				
	27			APC				
	28			APC				
	29			APC				
	30			APC				
	31			APC				

Sampled By: Eldwin Kennedy EK Date: 1-16-20 Time:

Shipped Via: ☐ Fed Ex ☐ DHL ☐ UPS ☐ US Mail ☐ Courier ☒ Drop Off ☐ Other:

Relinquished By: Eldwin Kennedy EK	Relinquished By:	Relinquished By:
Date / Time: 1-16-20 4:30p	Date / Time:	Date / Time:
Received By:	Received By:	Received By:
Date / Time: 01.16.20 4:37pm PLO	Date / Time:	Date / Time:
Condition Acceptable? ☒ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No

IV INSPECTOR CERTIFICATION

IV. INSPECTOR CERTIFICATION

California Department of PublicHealth

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC HEALTH

LEAD-RELATED CONSTRUCTION CERTIFICATE

INDIVIDUAL:	CERTIFICATE TYPE:	NUMBER:	EXPIRATION DATE:
	Lead Project Designer	LRC-00002680	8/23/2020
	Lead Inspector/Assessor	LRC-00002679	8/23/2020
	Lead Supervisor	LRC-00002678	8/23/2020

Eldwin Kennedy

Disclaimer: This document alone should not be relied upon to confirm certification status. Compare the individual's photo and name to another valid form of government issued photo identification. Verify the individual's certification status by searching for Lead-Related Construction Professionals at www.cdph.ca.gov/programs/clppb or calling (800) 597-LEAD.

VI. DISCLAIMER/REPORT LIMITATIONS

VI. DISCLAIMER/REPORT LIMITATIONS

All reports and recommendations are based on conditions and practices observed and information made available to Environmental Assistance Group (EAG) by the client and the designated sites/facilities on the days the inspection was completed. This report does not purport to set forth all hazards, or to indicate that other hazards do not exist. No responsibility is assumed by EAG for the control or correction of conditions or practices existing at the facilities, or at any other premises surveyed by EAG, for and on the behalf of the client. Services provided by EAG shall be governed by the standard of practice for professional services measured at the time those services are rendered.

All information contained in this report is proprietary and limited to the scope of services, parameters of the analytical methods used and the conditions present at the time of this inspection. Any references to quantities are considered estimates and are not to be construed as actual.

EXHIBIT "G"

REPORT of ASBESTOS ABATEMENT and LEAD CONTAINING PAINT STABILIZATION

Conducted at

EL MONTE UNION HIGH SCHOOL DISTRICT

ROSEMEAD HIGH SCHOOL BOYS LOCKER ROOM

AUDITORIUM LOBBY

CAFETERIA HOT WATER TANK ROOM

HazTrainer Multinational INC DBA
Environmental Assistance Group
16835 Algonquin Street #412, Huntington Beach CA. 92649
Phone 949-237-1036 E-mail comply@haztrainer.com

REPORT of ASBESTOS ABATEMENT and LEAD CONTAINING PAINT STABILIZATION

Conducted at

EL MONTE UNION HIGH SCHOOL DISTRICT
ROSEMEAD HIGH SCHOOL BOYS LOCKER ROOM
AUDITORIUM LOBBY
CAFETERIA HOT WATER TANK ROOM
9063 E. MISSION DRIVE
ROSEMEAD, CALIFORNIA 91770

Prepared for

NORMA MACIAS, DIRECTOR OF
FACILITIES, MAINTENANCE, OPERATIONS AND TRANSPORTATION
EL MONTE UNION HIGH SCHOOL DISTRICT
1003 N. DURFEE AVENUE
SOUTH EL MONTE, CALIFORNIA 91733

Prepared by

ENVIRONMENTAL ASSISTANCE GROUP
16835 Algonquin Street #412
Huntington Beach CA. 92649

Project Number: MEHR422

April 2022

Report generated by

Eldwin “Ed” Kennedy, Certified Asbestos Consultant CAC# 93-1429
and Certified Lead Professional CLP# 4092
President
Environmental Assistance Group

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

I. EXECUTIVE SUMMARY

INTRODUCTION

On February 2 through February 4, 2021, Environmental Assistance Group represented by Blain Robey and Perry Robey, under the supervision of Ed Kennedy, Certified Asbestos Consultant (CAC) and Certified Lead Professional (CLP), monitored the stabilization of paint in the Boys Locker Room and the Auditorium Lobby and the removal of asbestos pipe and tank insulation in the Cafeteria Hot Water Tank Room at Rosemead High School. The paint stabilization was needed because of loose and peeling lead containing paint. The asbestos containing tank insulation removal was necessary because the tank was abandoned. Air monitoring was conducted before, during and after the asbestos work. Dust wipe clearance samples were collected from smooth surfaces at the conclusion of the stabilization work. Sun Environmental of Torrance California conducted the abatement work.

METHOD

Polyethylene (poly) critical barriers and full containment with warning signs were constructed outside the Tank Room where asbestos abatement was to occur. The containment was placed under negative air pressure to ensure airborne fibers inside, did not release to the outside. During the project, air samples were collected utilizing high volume air vacuum pumps. Ambient air samples were analyzed by phase contrast microscopy (PCM). Clearance air samples were analyzed by transmission electron microscopy (TEM)
Critical barriers and lead warning signs were installed prior to the lead containing paint stabilization work. After the stabilization was completed, dust wipe clearance samples were collected from smooth surfaces. SGS Forensic Laboratories in Carson Ca. analyzed the ambient air samples by phase contrast microscopy (PCM) and the lead dust wipe samples by AA. The clearance TEM samples were analyzed by LA Testing Laboratories in Huntington Beach. All samples were analyzed by a NVLAP and California DHS certified laboratory in accordance with the Asbestos Hazard Emergency Response Act (AHERA) requirements for schools K-12 and/or the California Department of Public Health.

RESULTS

The asbestos abatement process proceeded according to plan and materials were abated as per the Scope of Work. As workers completed abatement, a visual inspection was conducted to ensure materials had been removed as required. The asbestos containing insulation on the hot water tank in the Cafeteria Hot Water Tank Room was removed. The results of background, ambient, and clearance air samples collected and analyzed by PCM were well below the permissible exposure level of 0.1 fibers per cubic centimeter of air, as established by the Occupational Safety and Health Act (OSHA). The two clearance samples analyzed by TEM were none detected (ND) for asbestos structures. The Hot Water Tank Room in the Cafeteria was cleared for reoccupancy.

The lead containing paint stabilization proceeded according to the Scope of Work. The dust wipe samples results showed that all 6 dust wipe samples collected from the Boys Locker Room and the 4 dust wipes collected from the Auditorium Foyer were well below the EPA recommended threshold level of 40 micrograms per square foot (ug/ft^2) for indoor floors. Both Rooms was cleared for reoccupancy and repainting.

II. ASBESTOS AIR SAMPLE ANALYSES REPORTS

LA Testing
5431 Industrial Drive Huntington Beach, CA 92649
Tel/Fax: (714) 828-4999 / (714) 828-4944
http://www.LATesting.com / gardengrovelab@latesting.com

LA Testing Order: 332209183
Customer ID: ENAG42
Customer PO:
Project ID:

Attention: Ed Kennedy
Environmental Assistance Group
16835 Algonquin Street, Suite 412
Huntington Beach, CA 92649

Project: Rosemead HS Mehr422

Phone: (661) 304-8981
Fax:
Received Date: 04/20/2022 17:10 PM
Analysis Date: 04/21/2022
Collected Date: 04/20/2022

Test Report: Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM) Performed by EPA 40 CFR Part 763 Appendix A to Subpart E

Sample	Location	Volume (Liters)	Area Analyzed (mm²)	Non Asb	Asbestos Type(s)	#Structures ≥0.5µ < 5µ	#Structures ≥5µ	Analytical Sensitivity (S/cc)	Asbestos Concentration (S/mm²)	Asbestos Concentration (S/cc)
MEHREA422-1 *332209183-0001*	Northwest corner	1413.00	0.0625	1	None Detected	0	0	0.0044	<16.00	<0.0044
MEHREA422-2 *332209183-0002*	Southeast corner	1413.00	0.0625	0	None Detected	0	0	0.0044	<16.00	<0.0044
MEHREA422-3 *332209183-0003*	Blank	0.00			Not Analyzed					N/A
MEHREA422-4 *332209183-0004*	Field blank	0.00			Not Analyzed					N/A

Analyst(s)
Jeffrey Deboo (2)

Michael Chapman, Laboratory Manager
or other approved signatory

Initial report from: 04/21/2022 10:06 AM

Asbestos Chain of Custody (Air, Bulk, Soil)

LA Testing Order Number / Lab Use Only

#332209183

LA Testing
520 Mission Street
South Pasadena, CA 91030

PHONE: 800-303-0047
EMAIL: pasadenalab@latesting.com

If Bill-To is the same as Report-To leave this section blank. Third-party billing requires written authorization.

Customer Information		Billing Information	
Customer ID:	ENAG42	Billing ID:	
Company Name:	Environmental Assistance Group	Company Name:	
Contact Name:	Ed Kennedy	Billing Contact:	
Street Address:	16853 Algonquin street #412	Street Address:	
City, State, Zip:	Huntington Beach CA. 92649	City, State, Zip:	
Country:	USA	Country:	
Phone:	661-304-8981	Phone:	
Email(s) for Report:	comply@haztrainier.com	Email(s) for Invoice:	

Project Information

Project Name/No: ROSEMEAD HS MEHR422

Purchase Order:

LAT LIMS Project ID: (If applicable, LA Testing will provide)

US State where samples collected: CA

State of Connecticut (CT) must select project location: ☐ Commercial (Taxable) ☐ Residential (Non-Taxable)

Sampled By Name: BLAINE ROBEY

Sampled By Signature:

No. of Samples in Shipment

Turn-Around-Time (TAT)

☐ 3 Hour ☐ 4-4.5 Hour AHERA ONLY ☑ 6 Hour ☐ 24 Hour ☐ 32 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☐ 1 Week ☐ 2 Week

TEM Air 3-6 Hour, please call ahead to schedule. 32 Hour TAT available for select tests only; samples must be submitted by 11:30 am.

Test Selection

PCM Air
- ☐ NIOSH 7400
- ☐ NIOSH 7400 w/ 8hr. TWA

PLM - Bulk (reporting limit)
- ☐ PLM EPA 600/R-93/116 (<1%)
- ☐ PLM EPA NOB (<1%)
- ☐ POINT COUNT
  - ☐ 400 (<0.25%) ☐ 1,000 (<0.1%)
- POINT COUNT w/ GRAVIMETRIC
  - ☐ 400 (<0.25%) ☐ 1,000 (<0.1%)
- ☐ NIOSH 9002 (<1%)
- ☐ NYS 198.1 (Friable - NY)
- ☐ NYS 198.6 NOB (Non-Friable - NY)
- ☐ NYS 198.8 (Vermiculite SM-V)

TEM - Air
- ☑ AHERA 40 CFR, Part 763
- ☐ NIOSH 7402
- ☐ EPA Level II
- ☐ ISO 10312"

TEM - Bulk
- ☐ TEM EPA NOB
- ☐ NYS NOB 198.4 (Non-Friable-NY)
- ☐ TEM EPA 600/R-93/116 w Milling Prep (0.1%)

Other Test (please specify)

TEM - Settled Dust
- ☐ Microvac - ASTM D5755
- ☐ Wipe - ASTM D6480
- ☐ Qualitative via Filtration Prep
- ☐ Qualitative via Drop Mount Prep

Soil - Rock - Vermiculite (reporting limit)*
- ☐ PLM EPA 600/R-93/116 with milling prep (<0.25%)
- ☐ PLM EPA 600/R-93/116 with milling prep (<0.1%)
- ☐ TEM EPA 600/R-93/116 with milling prep (<0.1%)
- ☐ TEM Qualitative via Filtration Prep
- ☐ TEM Qualitative via Drop Mount Prep

*Please call with your project-specific requirements.

☐ Positive Stop - Clearly Identified Homogeneous Areas (HA) | Filter Pore Size (Air Samples) ☐ 0.8um ☐ 0.45um

Sample Number	Sample Location / Description	Volume, Area or Homogeneous Area	Date / Time Sampled (Air Monitoring Only)
MEHR422-1	NORTHWEST CORNER	1413	4/20/22 1253-1530
-2	SOUTHEAST CORNER	1413	1254-1531
-3	BLANK		
-4	FIELD BLANK		

Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)

DO NOT ANALYZE BLANKS

Method of Shipment:		Sample Condition Upon Receipt:	
Relinquished by: BLAINE ROBEY	Date/Time: 4/20/22	Received by: MT(WI)	Date/Time 4/20/22 5:10
Relinquished by:	Date/Time:	Received by:	Date/Time

Controlled Document - COC-05 LAT Asbestos R7 04/29/2021

☑ AGREE TO ELECTRONIC SIGNATURE (By checking, I consent to signing this Chain of Custody document by electronic signature.)

SGS FORENSIC LABORATORIES

Final Report

Airborne Fiber Analysis

NIOSH 7400 Method, Issue 3, 14 June 2019, counting rules 'A'

Environmental Assistance Group
Ed Kennedy
16835 Algonquin St.
#412
Huntington Beach, CA 92649

Client ID: L1206
Report Number: A296955
Date Received: 04/19/22
Date Analyzed: 04/20/22
Date Printed: 04/20/22
First Reported: 04/20/22

Job ID/Site: MEHREA422; Rosemead HS, Cafeteria Rm Hot Water Heater

SGSFL Job ID: L1206
Total Samples Submitted: 3
Total Samples Analyzed: 3

Sample ID	Lab Number	Date Collected	Volume (L)	Fibers	Fields	Fibers/mm^2	LOD F/cc	Fibers/cc
MEHREA422-21	**51538314**	04/19/22	1380.0	1.5	100	<7.0	0.002	< **0.002**
MEHREA422-22	**51538315**	04/19/22	1395.0	2.5	100	<7.0	0.002	< **0.002**
MEHREA422-23	**51538316**	04/19/22	0.0	0.0	100	--	--	--

Comments: This result was used to blank correct the other samples on this rpt. Blank filters are reported only as # of fibers & fields counted.

Tiffani Ludd, Laboratory Supervisor, Carson Laboratory

Intralaboratory Relative Standard Deviation (Sr) per 100 graticule fields: 5 to 20 fibers: 0.23; >20 to 50 fibers: 0.19; >50 fibers: 0.13

Note* Sampling data used in this report was provided by the client as noted on the associated chain of custody form.

20535 South Belshaw Avenue, Carson, CA 90746 / Telephone: (310) 763-2374 (888) 813-9417 / Fax: (310) 763-4450

SGS FORENSIC LABORATORIES

Analysis Request Form (COC)

Client Name & Address: Client No.: L1206

Environmental Assistance Group
16835 Algonquin Street #412
Huntington Beach CA 92649

PO / Job#: MEHREA422 Date: 4/19/22

Turn Around Time: Same Day / (1Day) / 2Day / 3Day / 4Day / 5Day

☒ PCM: ☒ NIOSH 7400A / ☐ NIOSH 7400B ☐ Rotometer

☐ PLM: ☐ Standard / ☐ Point Count 400 - 1000 / ☐ CARB 435

Contact: Ed Kennedy Phone: (661) 304-8981

E-mail: comply@haztrainer.com

☐ TEM Air: ☐ AHERA / ☐ Yamate2 / ☐ NIOSH 7402
☐ TEM Bulk: ☐ Quantitative / ☐ Qualitative / ☐ Chatfield
☐ TEM Water: ☐ Potable / ☐ Non-Potable / ☐ Weight %
☐ TEM Dust: ☐ D5755 (microvac) / ☐ D6480 (wipe)

Site Name: ROSEMEAD HS

☐ IAQ Particle Identification (PLM LAB) ☐ PLM Opaques/Soot
☐ Particle Identification (TEM LAB) ☐ Special Project

Site Location: CAFETERIA HOT WATER HEATER RM.

☐ Metals Analysis Matrix: Method: Analytes:

Comments: 1 of 1

☐ Silica in Air ☐ w/Gravimetry
☐ Quartz Only

Sample ID	Date / Time	Sample Location / Description	FOR AIR SAMPLES ONLY Type	Time On/Off	Avg LPM	Total Time	Sample Area / Air Volume
MEHREA422-21	4/19/22	AMBIENT NEAR DECON ENTRANCE	A P C	0906 / 1038	15	92	1380
-22		AMBIENT NEAR NEGATIVE EXHAUST	A P C	0908 / 1041	15	93	1395
-23		BLANK	A P C				
			A P C				
			A P C				
			A P C				
			A P C				
			A P C				
			A P C				
			A P C				

Sampled By: B Robey Date/Time: 4/19/22 Shipped Via: ☐ Fed Ex ☐ UPS ☐ US Mail ☐ Courier ☒ Drop Off ☐ Other:

Relinquished By: B Robey	Relinquished By:	Relinquished By:
Date / Time: 4/19/22	Date / Time:	Date / Time:
Received By:	Received By:	Received By:
Date / Time: 4/19/22 3:35pm DTO	Date / Time:	Date / Time:
Condition Acceptable? ☒ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No

III. LEAD DUST WIPE SAMPLE ANALYSES REPORTS

SGS FORENSIC LABORATORIES

Final Report

Metals Analysis of HUD Wipes

(AIHA-LAP, LLC Accreditation, Lab ID #101629)

Environmental Assistance Group
Ed Kennedy
16835 Algonquin St.
#412
Huntington Beach, CA 92649

Client ID: L1206
Report Number: M241121
Date Received: 04/19/22
Date Analyzed: 04/20/22
Date Printed: 04/20/22
First Reported: 04/20/22

Job ID / Site: MEHR422; Rosemead HS, Boys Locker Room
Date(s) Collected: 04/19/22

SGSFL Job ID: L1206
Total Samples Submitted: 6
Total Samples Analyzed: 6

Sample Number	Lab Number	Analyte	Result	Result Units	Reporting Limit*	Method Reference
MEHR422-10	LM216671	Pb	23	ug	8	NIOSH 9100/7082
MEHR422-11	LM216672	Pb	28	ug	8	NIOSH 9100/7082
MEHR422-12	LM216673	Pb	< 8	ug	8	NIOSH 9100/7082
MEHR422-13	LM216674	Pb	13	ug	8	NIOSH 9100/7082
MEHR422-14	LM216675	Pb	< 8	ug	8	NIOSH 9100/7082
MEHR422-15	LM216676	Pb	17	ug	8	NIOSH 9100/7082

* The Reporting Limit represents the lowest amount of analyte that the laboratory can confidently detect in the sample, and is not a regulatory level. The Units for the Reporting Limit are the same as the Units for the Final Results.

Beatriz Hinojosa, Laboratory Supervisor, Carson Laboratory

20535 South Belshaw Avenue, Carson, CA 90746 / Telephone: (310) 763-2374 (888) 813-9417 / Fax (310) 763-4450

SGS FORENSIC LABORATORIES

Analysis Request Form (COC)

Client Name & Address: Client No.: L1206

Environmental Assistance Group
16835 Algonquin Street #412
Huntington Beach CA 92649

PO / Job#: MEHR422 Date: 4/19/22

Turn Around Time: Same Day / 1Day / 2Day / 3Day / 4Day / 5Day

☐ PCM: ☐ NIOSH 7400A / ☐ NIOSH 7400B ☐ Rotometer

☐ PLM: ☐ Standard / ☐ Point Count 400 - 1000 / ☐ CARB 435

Contact: Ed Kennedy Phone: (661) 304-8981

E-mail: comply@haztrainer.com

☐ TEM Air: ☐ AHERA / ☐ Yamate2 / ☐ NIOSH 7402
☐ TEM Bulk: ☐ Quantitative / ☐ Qualitative / ☐ Chatfield
☐ TEM Water: ☐ Potable / ☐ Non-Potable / ☐ Weight %
☐ TEM Dust: ☐ D5755 (microvac) / ☐ D6480 (wipe)

Site Name: ROSEMEAD HS

☐ IAQ Particle Identification (PLM LAB) ☐ PLM Opaques/Soot
☐ Particle Identification (TEM LAB) ☐ Special Project

Site Location: BOYS LOCKER ROOM

☒ Metals Analysis Matrix: WIPE Method: AA
Analytes: LEAD

Comments: PLEASE REPORT IN PERCENT BY WEIGHT

☐ Silica in Air ☐ w/Gravimetry
☐ Quartz Only

Sample ID	Date / Time	Sample Location / Description	FOR AIR SAMPLES ONLY: Type	Time On/Off	Avg LPM	Total Time	Sample Area / Air Volume
MEHR422 – 10	4/19/22	NORTHEAST CORNER of LOCKER ROOM. 6" FROM N & E. WALL	A P C				
– 11		SOUTHEAS AREA. ON TOP of LOCKER # 1004	A P C				
– 12		SOUTH WEST AREA. 2' FROM W. WALL & 10' FROM S. BRICK WALL	A P C				
– 13		WEST WALL AT NORTH WEST ADJACENT ROOM THRESHOLD	A P C				
– 14		NORTH EAST AREA. ON TOP of LOCKER # 946	A P C				
– 15		2" SOUTH of LOCKER #582 CENTER of ROOM	A P C				
			A P C				
			A P C				
			A P C				
			A P C				

Sampled By: B Robey Date/Time: 4/19/22 Shipped Via: ☐ Fed Ex ☐ UPS ☐ US Mail ☐ Courier ☒ Drop Off ☐ Other:

Relinquished By: B Robey	Relinquished By:	Relinquished By:
Date / Time: 4/19/22	Date / Time:	Date / Time:
Received By:	Received By:	Received By:
Date / Time: 4-19-22 3:35pm D/C	Date / Time:	Date / Time:
Condition Acceptable? ☒ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No

SGS FORENSIC LABORATORIES

Final Report

Metals Analysis of HUD Wipes

(AIHA-LAP, LLC Accreditation, Lab ID #101629)

Environmental Assistance Group
Ed Kennedy
16835 Algonquin St.
#412
Huntington Beach, CA 92649

Client ID: L1206
Report Number: M241122
Date Received: 04/19/22
Date Analyzed: 04/20/22
Date Printed: 04/20/22
First Reported: 04/20/22

Job ID / Site: MEHR422; Rosemead HS, Auditorium Foyer
Date(s) Collected: 04/19/22

SGSFL Job ID: L1206
Total Samples Submitted: 4
Total Samples Analyzed: 4

Sample Number	Lab Number	Analyte	Result	Result Units	Reporting Limit*	Method Reference
MEHR422-1	LM216677	Pb	21	ug	8	NIOSH 9100/7082
MEHR422-2	LM216678	Pb	29	ug	8	NIOSH 9100/7082
MEHR422-3	LM216679	Pb	13	ug	8	NIOSH 9100/7082
MEHR422-4	LM216680	Pb	< 8	ug	8	NIOSH 9100/7082

* The Reporting Limit represents the lowest amount of analyte that the laboratory can confidently detect in the sample, and is not a regulatory level. The Units for the Reporting Limit are the same as the Units for the Final Results.

Beatriz Hinojosa, Laboratory Supervisor, Carson Laboratory

20535 South Belshaw Avenue, Carson, CA 90746 / Telephone: (310) 763-2374 (888) 813-9417 / Fax: (310) 763-4450

SGS FORENSIC LABORATORIES

Analysis Request Form (COC)

Client Name & Address: Environmental Assistance Group
116835 Algonquin Street # 412
Huntington Beach, CA. 92649

Client No.: L 1206

PO / Job#: MEHR422 Date: 4/19/22

Turn Around Time: Same Day / 1Day / 2Day / 3Day / 4Day / 5Day

☐ PCM: ☐ NIOSH 7400A / ☐ NIOSH 7400B ☐ Rotometer

☐ PLM: ☐ Standard / ☐ Point Count 400 - 1000 / ☐ CARB 435

Contact: Ed Kennedy Phone: (661) 304-8981

E-mail: comply@haztrainer.com

☐ TEM Air: ☐ AHERA / ☐ Yamate2 / ☐ NIOSH 7402
☐ TEM Bulk: ☐ Quantitative / ☐ Qualitative / ☐ Chatfield
☐ TEM Water: ☐ Potable / ☐ Non-Potable / ☐ Weight %
☐ TEM Dust: ☐ D5755 (microvac) / ☐ D6480 (wipe)

Site Name: ROSEMEAD HS

☐ IAQ Particle Identification (PLM LAB) ☐ PLM Opaques/Soot
☐ Particle Identification (TEM LAB) ☐ Special Project

Site Location: AUDITORIUM FOYER

☒ Metals Analysis Matrix: WIPE Method: AA
Analytes: LEAD

Comments: PLEASE REPORT IN PERCENT BY WEIGHT

☐ Silica in Air ☐ w/Gravimetry
☐ Quartz Only

Sample ID	Date / Time	Sample Location / Description	FOR AIR SAMPLES ONLY: Type (A / P / C)	Time On/Off	Avg LPM	Total Time	Sample Area / Air Volume
MEHR422 - 1	4/19/22	By Door 3 ORCHESTRA. 3' SOUTH of DOOR. 6" FROM WEST WALL	A / P / C				
2	"	By Door 102. 1' EAST of DOOR. 6" FROM S. WALL	A / P / C				
3	"	By Door 106. 1' EAST of DOOR. 6" FROM N. WALL	A / P / C				
4	"	By Door 1 ORCHESTRA. 6" SOUTH of DOOR 6" FROM W. WALL	A / P / C				
			A / P / C				
			A / P / C				
			A / P / C				
			A / P / C				
			A / P / C				
			A / P / C				

Sampled By: Ed Kennedy PR Date/Time: 4/19/22 Shipped Via: ☐ Fed Ex ☐ UPS ☐ US Mail ☐ Courier ☐ Drop Off ☐ Other:

Relinquished By: Ed Kennedy PR	Relinquished By:	Relinquished By:
Date / Time: 4/19/22	Date / Time:	Date / Time:
Received By:	Received By:	Received By:
Date / Time: 4/19/22 3:35pm PDT	Date / Time:	Date / Time:
Condition Acceptable? ☒ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No

IV. DAILY LOG SHEETS

V. INSPECTORS CERTIFICATIONS

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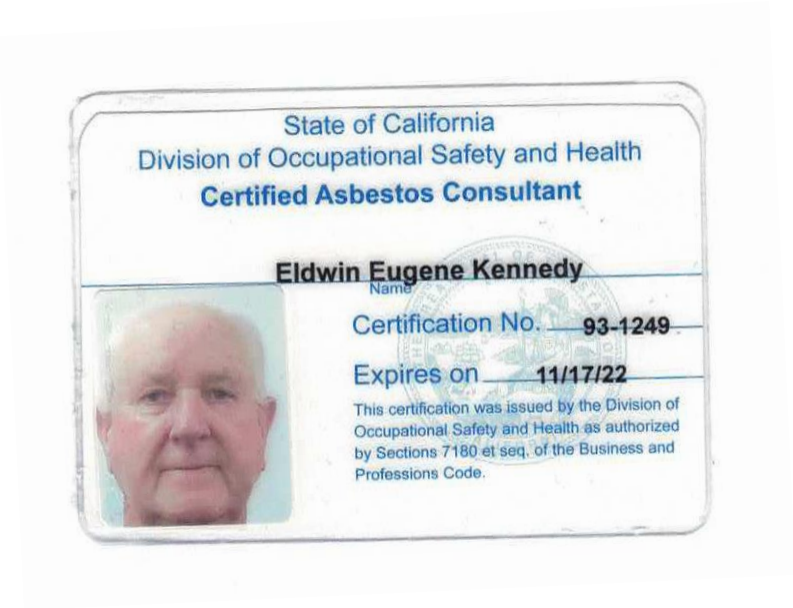
State of California
Division of Occupational Safety and Health
Certified Asbestos Consultant

Eldwin Eugene Kennedy
Name

Certification No. **93-1249**

Expires on **11/17/22**

This certification was issued by the Division of Occupational Safety and Health as authorized by Sections 7180 et seq. of the Business and Professions Code.

VI. DISCLAIMER/REPORT LIMITATIONS

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All reports and recommendations are based on conditions and practices observed and information made available to Environmental Assistance Group (EAG) by the client and the designated sites/facilities on the days the abatement was completed. Services provided by EAG shall be governed by the standard of practice for professional services measured at the time those services are rendered.

All information contained in this report is proprietary and limited to the scope of services, parameters of the analytical methods used, and the conditions present at the time of this oversight and monitoring. Any references to quantities are considered estimates and are not to be construed as actual.